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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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MEMBERS OF THE CLUB will please remit their annual dues for 1898, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

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BULLETIN

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JANUARY 1898

The Anthocerotaceae of North America.

By Marshall A. Howe.

(Plates 321–326.)

Important contributions to our knowledge of the North American Anthocerotaceae have been made by Schweinitz,[*] Sullivant,[†] Mottier,[‡] and Campbell,[§] but the principal paper on the subject from the systematic point of view, is that published by Mr. Coe F. Austin in the Bulletin of the Torrey Botanical Club, for April, 1875 (6: 25–29), under the title, "Notes on the Anthocerotaceae of North America, with Descriptions of Several New Species." Nine new species were proposed in Mr. Austin's paper, some of them, however, provisionally—"introduced, along with others, for the purpose of calling the attention of collectors more directly to this most obscure family of the Hepaticae." Elsewhere three ad-

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[*] Schweinitz, L. D. Specimen Florae Americae Septentrionalis Cryptogamicae; sistens Muscos Hepaticos huc usque in Am. Sept. observatos. 8vo, pp. 27. Raleigh, 1821.

On two remarkable Hepatic Mosses found in North Carolina. Jour. Philad. Acad. Nat. Sci. 2: 361–370, 1 pl., 1822.

[†] Sullivant, W. S. Musci Alleghanienses [Exsicc.] 1845. Id. [Reprint of tickets.] 8vo, pp. 87. Columbus: 1846.

Contributions to the Bryology and Hepaticology of North America. Part I Mem. Amer. Acad., new ser. 3: 57–66. *pl. 1–5.* 1846.

[‡] Mottier, D. M. Contributions to the Life-History of Notothylas. Annals of Botany. 8: 391–402. *pl. 20 and 21.* 1894.

[§] Campbell, D. H. The Structure and Development of the Mosses and Ferns. 8vo, pp. 544. London and New York: 1895.

[Issued January 25.]

ditional species have been proposed by Austin. It will thus be readily understood that for any adequate review of the North American species of this order, access to the herbarium of Mr. Austin is a necessity. But, unfortunately, after the death of Mr. Austin, his collection of Hepaticae was allowed to leave America, having been purchased by Dr. Carrington and Mr. Pearson, of England, between whom it was divided, Dr. Carrington's portion going finally to the Owens College of Manchester. The inconvenience to American students, of having the Austin collection on the other side of the Atlantic is, however, largely compensated for by the ready liberality of Mr. Pearson, and also of Professor Weiss of the Owens College. Through the kindness of these gentlemen in sending whatever was asked for, we have been able to examine everything of importance in the Austin collection of Anthocerotaceae, including the originals of all his species with the exception of *Anthoceros Joorii*, which is probably of little moment, as it was finally reduced to *A. Ravenelii* by Austin himself. We are also much indebted to Professor Romauldo Pirotta, of the University of Rome, for generously sending for examination the scanty fragments of *Anthoceros caespiticius* De Not., from the De Notaris herbarium—all that is certainly known to exist of this obscure species; to Professor Massalongo for specimens of *Anthoceros dichotomus* Raddi from the Raddian herbarium; to the Philadelphia Academy of Natural Sciences for the loan of the Schweinitz collection; to Dr. B. L. Robinson for the privilege of examining *Anthoceros tuberosus* Tayl., from the Taylor herbarium; and to Herr Stephani, Dr. Evans, Professor Macoun, and Rev. C. H. Demetrio for various specimens. Outside of the specimens named, the present revision is founded on the herbarium of Professor Underwood, the collections of the writer in California, and the herbarium of Columbia University. To Professor Underwood, who has facilitated the work in all possible ways, our thanks are especially due.

ANTHOCEROTACEAE.

Gametophyte a wholly leafless thallus, commonly flat, orbicular, or semiorbicular, more or less lobed or radiately dissected, sometimes subpinnate (*Dendroceros*), or ribbon-shaped and subdichotomously branched, with, or more frequently without, a well-defined costa, usually of several layers of cells, often with interior mucilage cavities, more rarely with intercellular air-spaces, without proper epidermis, but provided on the ventral surface, sometimes also on the dorsal, with inconspicuous clefts (" stomata," " mucilage-slits "), the thallus becoming through these infected with *Nostoc* colonies; cells with a single large chloroplast commonly enclosing the nucleus.

Sexual organs embedded in the thallus; antheridia arising endogenously, short-stalked, single or in groups of 2–4 (rarely more), occupying cavities separated from the dorsal surface by two layers of cells, the covering ruptured at maturity; walls of archegonium confluent with surrounding cells of the thallus, the neck-canal communicating with dorsal surface at maturity of the egg-cell. Special calyptra not differentiated. " Involucre " tubular, of several layers of cells, formed from archegonium-wall and adjacent cells of thallus, usually soon broken through at the apex by the elongating capsule and remaining as a sheath about its base, or (in *Notothylas*) irregularly torn by external agencies.

Sporogonium consisting of a pod-like, usually erect and much elongated capsule, a bulbous foot, and a short intervening zone occupied by a long-active meristematic tissue; capsule dehiscing, with rare exceptions, from the apex downward by two valves, its walls containing chlorophyl and in most species of *Anthoceros* bearing stomata, each with two crescentic guard-cells; a slender thread-like columella, surrounded throughout and covered at the apex by the spore-forming layer, probably always present, but sometimes early disintegrated and obscure. Spores more or less plainly tetrahedral, long adhering in fours, smooth, verrucose, papillate, or echinulate, ripening successively from apex of capsule downward; sterile cells from the archesporium single and subcubical at maturity, or, more often, elongated and forming heteromorphic, variously contorted, occasionally branched filaments of 2–4 cells, sometimes (*Anthoceros* sp. and *Dendroceros*—in tropics and southern hemisphere) with one or more well developed spiral bands, or, more commonly (pseudo-elaters), with spiral thickenings rudimentary or wanting.

Three genera, *Anthoceros*, *Dendroceros*, and *Notothylas*, are ordinarily recognized, the second of which is not known to occur within our limits.

ANTHOCEROS L. Sp. Pl. 2: 1139. 1753. Ex Mich. Gen. Pl. 10, *pl.* 7, *f.* *1*, *2*. 1729.

Thallus suborbicular, variously lobed or irregularly dissected, now and then somewhat ribbon-shaped and subdichotomous, of more than one layer of cells throughout, costa wanting, indistinct, or rarely prominent; monoicous, proterandrous, or sometimes dioicous (?) *; capsule erect, bivalved, much exceeding the involucre in length, usually very long, with stomata (in the North American species). Spores granulose-papillate, tuberculate, or echinulate, rarely nearly smooth; sterile cells (in all our species) without spiral thickenings.

Key to the Species.

- Spores yellow.
  - Thallus with peduncled tubers from ventral surface.
    - Thallus opaque; tubers few (1–3 to a segment), .25–1 mm. in diam., on peduncles .1–.4 mm. thick. 5. *A. phymatodes.*†
    - Thallus pellucid; tubers numerous, .15–.3 mm. in diam., on peduncles .08–.09 mm. thick. 6. *A. Donnellii.*
  - Thallus without ventral peduncled tubers.
    - Capsule 3–6 mm. long; pseudo-elaters mostly of single cells, often as broad as long. 4. *A. Hallii.*
    - Capsule 6–50 mm. long; pseudo-elaters mostly of 2–4 elongated (2–10:1) cells.
      - Spores with a few (8–15) crescentic verrucae on convex (outer) surface, or nearly smooth; thallus usually with marginal, sometimes peduncled, glandular-thickenings. 3. *A. Pearsoni.*
      - Spores thickly granulose-papillate.
        - Involucres .8–2.5 mm. high, usually expanded at mouth; major segments of thallus 4–15 mm. long. 1. *A. laevis.*
        - Involucres 2–6.5 mm. high, scarcely or not at all expanded at mouth; major segments of thallus 8–30 mm. long. 2. *A. Carolinianus.*

---

* Certain species of *Anthoceros* have been described as dioicous, yet in a genus of which the best known representatives are proterandrous, and in which the archegonia are observed with so much difficulty, it may be suspected that careful investigation, by modern methods, would show proterandry to obtain in all.

† Mature spores of *A. phymatodes* are unknown, but the close affinity of this species with *A. dichotomus* of southern Europe makes it nearly certain that it belongs in the yellow-spored series.

Spores fuscous or black.

Pseudo-elaters mostly of 1–4 elongated (2–10:1) cells.

Pseudo-elaters 12–18 μ in width; spores 35–58 μ in maximum diameter, the outer face with numerous (75–125) spines or papillae 3 μ or more in length; involucre 1–5 mm. high. 7. *A. punctatus.*

Pseudo-elaters 8–14 μ in width; spores 45–63 μ in maximum diameter, the outer face with very numerous (125–225) spines or papillae less than 3 μ in length (or sometimes longer in var. *stomatifer*); involucre 2–9 mm. high (Pacific coast). 8. *A. fusiformis.*

Pseudo-elaters mostly of single cells about as broad as long, these sometimes in catenulate groups or variously adherent, or fragmentary and inconspicuous.

Spores 70–100 μ in maximum diameter, scarcely angled; capsule 8–20 mm. long. 9. *A. Ravenelii.*

Spores 48–65 μ in maximum diameter, rounded-tetrahedral; capsule 3–6 mm. long. 10. *A. Macounii.*

1. ANTHOCEROS LAEVIS L. Sp. Pl. 2: 1139. 1753.

Anthoceros Oreganus Aust. Bull. Torr. Bot. Club, 6: 26. 1875.

Anthoceros Mohrii Aust. Bull. Torr. Bot. Club, 6: 304. 1879.

Thallus nearly smooth and flat, rarely with elevate-crispate margins, dark green, exhibiting a somewhat fatty lustre, subradiately dissected, ecostate; major segments irregularly obovate or obcuneate, 4–15 × 2–5 mm., once or twice subdichotomously cleft, rounded or emarginate at apices, 6–8 cells thick in the middle, becoming gradually 3- or 2-stratose toward the very rarely glandular-thickened margin; surface-cells mostly indistinct after drying, subrhombic to long-hexagonal, 30–105 × 24–40 μ, the inner cells much larger, hyaline, without evident air- or mucilage-cavities: monoicous (polyoicous?): involucres sometimes in pairs, cylindrical, commonly rather slender, at maturity usually more or less widened above and trumpet-shaped, .8–2.5 × .4–1.3 mm., the mouth entire, repand or sublobate, sometimes plicate, rarely scarious: capsule 10–35 (mostly 20–25) × .25–.42 mm., light brown, with a very short pedicel, the valves often much twisted; spores yellow, thickly granulose-papillate, especially on the convex (outer) face, 35–56 μ in maximum diameter; pseudo-elaters nearly colorless to light yellowish-brown, of 1–4 cells, geniculate, often branched, the cells extremely variable in size and form.

EXSICC. Drumm. Musc. Am. (So. States) 1841, no. 154 (as *A. punctatus*); Hep. Bor-Am. 123; Hep. Am. 4.

On moist ground, wet rocks, banks of rivulets and of roads. Not uncommon throughout the United States, with the exception of the Rocky Mountain region and the Pacific coast, where it is apparently rare. Canada (*fide* Austin). Specimens from New Orleans (Drumm. Musc. Am.—So. States—no. 154), White Plains, N. Y. (L. M. Underwood, Sept. 28, 1896,) and Muscatine, Iowa (B. Shimek, October, 1895), differ from the ordinary form in having the margins of the thallus here and there glandular-thickened and the surface cells rather more distinct.

Anthoceros Oreganus Aust. is known outside of the description only from a small and unsatisfactory specimen in the Austin collection, which may be fairly presumed to be the original. The packet bears on the outside the inscription in pencil "*Anthoceros* ——? Rocky Mts., Hall," and just above the dash "*Oreganus*" has been supplied later in ink, all evidently in Austin's handwriting. Inside the packet is a slip of manilla paper on which is written "24, moist earth, Oregon," in pencil by another hand, probably Hall's. The involucres in this specimen are rather short and 1–1.7 × .4–.65 mm., often somewhat widened at the mouth, but not especially constricted above the middle as described by Austin. The thallus is in a poor state of preservation. The spores in size, color and markings seem identical with those of the European *A. laevis* and we see no sufficient reason for separating it from this species. The thallus doubtless has glandular-thickenings like the forms alluded to above.

Anthoceros Mohrii Aust. was studied in the field by Austin, and was pronounced* by him distinct from *A. laevis*, but it may be inferred from his remarks that the comparisons may have been made wholly with *A. laevis* var. *major* Aust. (*A. Carolinianus* Michx.). The spores in the original specimen we find to be a little larger than in the typical *A. laevis* instead of smaller as described by Austin. They are, it is true, rather more coarsely and closely granulate-papillate than in the ordinary forms of *A. laevis*, yet the differences in this respect can hardly be defined with precision, and certain specimens of *Anthoceros laevis* from other localities show that this character cannot be depended upon. The thallus is lightly lacunose with rarely a suggestion of a lamella-like ridge. The tubers referred to by Mr. Austin were probably, for the most part, *Nostoc* colonies, which were not recognized by him in their true character in any of his descriptions of Anthocerotaceae. The view that the "tubers" were here mostly *Nostoc* colonies is supported by examination of a detached fragment enclosed in a small separate wrapper in the pocket containing the type material (Herb. Pearson). This scrap of the thallus contains several conspicuous protuberant globose *Nostoc* masses, but nothing in the nature of true tuberous thickening. In other portions of the type specimen, however, somewhat rounded glandular-thickenings, furnished beneath with root-hairs, occur, though rarely.

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* Bull. Torr. Bot. Club, 6: 304. 1879.

2. ANTHOCEROS CAROLINIANUS Michx. Fl. Bor-Am. 2: 280. 1803.

Anthoceros laciniatus Schwein. Spec. Fl. Am. Sept. Crypt. 25. 1821.

Anthoceros laevis tenuis Nees (*p. p.*) Naturg. Eur. Leberm. 4: 330. 1838.

Anthoceros laevis major Aust. Hep. Bor-Am. no. 123^b. 1873.

Thallus large, thin, ecostate, nearly smooth, prostrate, the margin often undulate-crisped and ascending, sometimes crowded and subcaespitose, light- or dark-green, a little pellucid or, on drying, opaque with a somewhat fatty lustre, dissected; major segments oblong or obovate, 1–3 times subdichotomously branched, 8–30 × 2–7 mm., more or less widened at the rounded crenate apex, 4–8 cells thick in the middle, passing gradually into a wide 3- or 2-stratose margin, or nearly uniform throughout; surface-cells distinct in terrestrial forms, obscure in the aquatic, irregularly rhombic, becoming elongate-hexagonal, 20–120 × 18–30 μ: monoicous: involucres sometimes united in pairs, thick-walled, somewhat pellucid, long-cylindrical, 2–5 × .5–1.1 mm., sometimes contracted or now a little widened toward the thin, subentire or repand-dentate, rarely scarious mouth, often longitudinally plicate toward the base: capsule slender, 25–50 × .25–.5 mm., pale brown, short-pedicellate, the valves twisted; spores and elaters as in *A. laevis.*

EXSICC. Hep. Bor-Am. 123^b; Hep. Am. 164.

On wet, gravelly ground and beside brooks, often nearly or wholly submerged. Found especially in the Southern States. Florida (Torrey, Austin, J. D. Smith, Underwood, Lighthipe, F. C. Straub); Georgia (Lesquereux); South Carolina (Ravenel); North Carolina (Schweinitz). What was undoubtedly this species came into the hands of Dillenius from Virginia, where it was collected by Mitchell. Sterile plants in the Austin collection from Closter, N. J. (Austin), and New Haven, Conn. (D. C. Eaton), seem also to belong here.

A. Carolinianus differs from *A. laevis* chiefly in greater size of the thallus, in the longer involucres, scarcely expanded, sometimes contracted, at the mouth, and in the (typically) more slender capsules. The species as a whole is perhaps to be looked upon as an aquatic or semi-aquatic analogue of *A. laevis*, from which it is probably not always distinct. It, however, departs so widely from the ordinary conception of *Anthoceros laevis* and is usually so easily recognizable that we think it has a fair claim to specific recognition. Schweinitz' plant (*A. laciniatus*) has oblong or almost linear segments. The original of Michaux is not found, we are informed, in his collections, now preserved at Paris.

ANTHOCEROS CAROLINIANUS OCCIDENTALIS var. nov.

Thallus usually densely caespitose, ascending, now and then with margins and lobes glandular thickened; involucres sometimes longer, 2–6.5 × .5–1 mm.; capsule less slender. (Plate 321.)

On wet rocks and on the banks of rivulets near the water-line. California (Underwood, Parish, McClatchie, Setchell, Jepson, Koch, Howe).

As the type of var. *occidentalis* we select a specimen collected by Mr. W. L. Jepson, near Olema, Marin county, California, April 1, 1893. This formed, when growing, wide cushions 3–4 cm. in depth; the margins of the frond are here but slightly or not at all glandular-thickened. In drying, the thallus is not infrequently much blackened. In the glandular-thickened forms, involucres which seem abnormally shortened and incrassate (2–2.5 × 1 mm.) are often found intermingled with the longer. Such involucres commonly have scarious mouths.

3. ANTHOCEROS PEARSONI sp. nov.

Thallus smooth, prostrate or ascending, rarely erect, mostly irregularly dissected; the major segments linear or elongate-flabelliform, 5–20 × 1–5 mm., often intertangled, sparingly lobed or two or three times subradiately dichotomous, plane or slightly concave, rarely costate ventrally at apices, in sterile plants usually 6–11 cells thick, gradually or abruptly reduced to three or four at the margin, in the fertile commonly expanded into a wide 3- or 2-stratose lamina with a lightly crisped periphery, the lobes in both often terminating in dark green, globose or difform, glandular-thickenings, .2–2 mm. in diameter, these sometimes long-peduncled, rarely descending and radiculose; surface-cells rather distinct, rhombic-trapezoidal to oblong, 20–70 × 20–30 μ, the inner larger but compact; *Nostoc* colonies usually abundant, ellipsoidal or fusiform: monoicous: involucres solitary or approximate in pairs, subterminal in erect forms, somewhat pellucid, mostly light green, elongate-cylindrical, 2.3–3.3 × .5–.85 mm., sometimes decumbent at base, the mouth entire, repand-dentate, often lacerate with age, now and then scarious: capsule pale brown, yellowish, or drab, slender, sulcate, 8–32 (mostly 20–24) × .24–.4 mm., rather thick-walled, the valves finally thin and often twisted, stomata abundant; columella filiform, naked; spores yellow, the convex face with a few (8–15) small, crescentic, rarely obsolete warts, otherwise smooth or most faintly granulose, 35–50 μ in maximum diameter; pseudo-elaters dilute yellow or occasionally tinged with brown, of 1–4 cells, geniculate and variously contorted, often branched, the cells 30–80 × 6–10 μ, with wall of nearly uniform thickness. (Plates 322 and 323.)

EXSICC. Hep. Am. 161 (as *A. laevis*).

On moist banks and dripping rocks. California (Bolander, Parish, Brandegee, Howe, Campbell, Hasse); Washington (Piper).

The commonest yellow-spored *Anthoceros* of California, and perhaps of the Pacific coast as a whole. We have seen as many as twenty specimens, ranging from southern California to Washington, and they are always very clearly distinct from *Anthoceros laevis*, *A. Carolinianus*, and *A. Hallii*; differing from the last-mentioned in having the capsule usually four times as long, in the much more perfect pseudo-elaters, composed of 1–4 elongated cells, in the spores being scarcely otherwise roughened than by 8–15 small crescentic verrucae, etc.; very different from both *A. laevis* and *A. Carolinianus*, in the character of the spore-markings, the spores of the two latter species being always thickly granulose-papillate. Sterile conditions can sometimes be only doubtfully distinguished from *A. Hallii*, but can be separated from glandular-thickened forms of *A. Carolinianus occidentalis* by the narrower segments and often peduncled glands. The species is extremely variable in thickness and form of thallus, though very constant in spore-markings. In its thicker, slightly costate conditions, particularly when the glandular-thickenings are long-stalked, descending, and tuber-like, the thallus bears some resemblance to that of *A. phymatodes*, but in all such cases, we believe, the attachment of the tubers never becomes strictly ventral; their peduncles can, with care, always be traced back to the margins of the frond. The glands or tubers are 10–25 cells in thickness and consist of a more or less distinctly defined capsule of 1–3 layers of undifferentiated cells enclosing cells containing at first an unusually large chloroplast and later filled with oil-drops or densely crowded with whitish granules. These organs are evidently food reservoirs, adapting the thallus to persistence through the dry summers of the region that the plant inhabits. In the neighborhood of San Francisco the thickenings begin to appear in January or February, attaining full development in May or June. In our no. 702, collected near Mendocino, California, these marginal thickenings often enclose numerous antheridia.

We take pleasure in dedicating this clearly marked species to Mr. W. H. Pearson, of Knutsford, Cheshire, England, whose careful work on the Hepaticae of Canada and of various other parts of the world is well known, and whose liberality in loaning the Austin collection of *Anthoceros* has been an important and much appreciated aid in the preparation of this paper.

The above description of *Anthoceros Pearsoni* is based upon various specimens, but our no. 16, collected at Mill Valley, Marin County, California, May 7, 1892, from which the figures of the spores, pseudo-elaters and capsules have been drawn, we consider the type of the species.

4. ANTHOCEROS HALLII Aust. Bull. Torr. Bot. Club, **6**: 26. 1875.

Anthoceros sulcatus Aust. *l. c.* 27.

Thallus caespitose, erect, more rarely prostrate-entangled, dark green or often extensively etiolated, sometimes indistinctly plicate-costate; the major segments attenuate at the base, flabelliform, or somewhat linear in the prostrate forms, 5–10 mm. long, 3–5 mm. broad above, sometimes once or twice subdichotomously cleft, crenate-lobed or repand at apical margins, 6–8 cells thick along the middle, otherwise 4–2-stratose, the lobes often terminating in irregular yellowish-brown or olive-green, glandular thickenings, .3–2 mm. broad, these sometimes descending and tuber-like; surface-cells quadrate-oblong to irregularly rhombic-pentagonal, $35–60 \times 25–30 \mu$; *Nostoc* colonies conspicuous, globose or fusiform: monoicous: antheridia usually in pairs: sporogonia very numerous; involucres from just below the apex of the thallus, in groups of 2–5 but distinct at base, obovate-quadrate to oblong-cylindrical, $1–2.3 \times .5–.72$ mm., repand-dentate or sometimes irregularly lacerate at mouth: capsule dull straw-colored, erect or a little curved, 3.3–6 (mostly 4–4.5) × .32–.56 mm., sulcate and compressed-quadrangular when dry, with acute or slightly winged angles, usually rather abruptly contracted below to a short pedicel, thick-walled, crowded with spores at maturity, marked with a narrow yellow suture on either side but long indehiscent, stomata large, the guard-cells yellowish; columella very slender and inconspicuous; spores yellow, the convex face with 20–35 wart-like papillae, the other faces faintly punctate near the middle, 44–58 μ in maximum diameter; pseudo-elaters of short, irregular, mostly unicellular fragments, often as broad as long, the walls unequally thickened.

EXSICC. Hep. Am. 162.

"On moist earth" and "in wet meadows." Silverton and Salem, Oregon (E. Hall); Seattle, Washington (C. V. Piper).

The fertile plant from Silverton (E. Hall, no. 26), which is first cited after Austin's diagnosis, should undoubtedly be considered the type of the species. This is preserved both in Herb. Pearson and in the Herbarium of the Owens College of Manchester, England. Its capsules are rather immature, as observed by Mr. Austin, but it is clearly the same specifically as *Anthoceros sulcatus* Aust., the original of which is represented by good specimens, under Austin's manuscript name, *Notothylas Hallii*, in both the herbaria named above. It is quite probable that the sterile plants from Oregon, also placed with *A. Hallii* by Austin and from which the original description was, doubtless, in part drawn, belong with *Anthoceros Pearsoni*, which has a somewhat larger thallus and a wholly different sporophyte, though in the absence of the latter phase it would perhaps be rash to assume to identify them positively. *Anthoceros Hallii* is very distinct—in the fertile condition, at least—from any of the other American Anthocerotaceæ.

The mature capsules are filled with ripened spores far below the mouth of the involucre, yet in only a few cases have we seen indications of dehiscence, which takes place—rather imperfectly, it may be—between two rows of narrow, yellow, thick-walled cells. Some of the dark algal colonies in the thallus are composed of detached cells 10–15 μ in diameter, consisting of a spherical, highly refractive centre surrounded by a thick, shriveled membrane. These appear to be resting spores derived from delicate inconspicuous filaments belonging to the Nostochineae, but possibly not identical with the *Nostoc* that most abounds in the thallus of the species. Black spherical masses 30–45 μ in diameter, belonging to a parasitic fungus, occur somewhat sparingly in the thallus and may be what Austin referred to as "black, tuber-like gemmae." The fungus is described in more detail in our remarks upon *Anthoceros Ravenelii*.

5. ANTHOCEROS PHYMATODES sp. nov.

Thallus dark green, blackening on drying, dissected; the segments dichotomous, oblong or linear in sterile plants, broader in the fertile, 4–10×.5–2.5 mm., prostrate or very slightly ascending at the apices, at first radiate, becoming later intricately entangled, narrowly canaliculate dorsally, with ascending sinuate or repand margins, obtuse, carinate with a broad thick, very distinct or sometimes obsolescent, naked or sparingly radiculose costa, this occupying nearly the whole of the narrower segments and sending down here and there a fleshy or elongated and slender process (.1–.4 mm. in thickness), terminated by a globose or ellipsoidal tuber, the latter .25–1 mm. in diameter, pale when living, yellowish-brown on drying, becoming finally closely covered with root-hairs; thallus 10–16 cells thick in region of costa, passing gradually or rather abruptly into the more or less extended 5–3-stratose marginal lamina; surface-cells rhombic to rhombic-oblong, 33–66 × 20–33 μ, indistinct after drying: involucres separate, cylindrical, 1.7–2 × .5 mm., smooth, truncate, entire or slightly repand at the mouth. (Plates 324 and 325.)

On compact soil in a nearly level open plot about fifty feet north of "The Old Mill," Mill Valley, Marin Co., California (Howe: Mar. 19, 1892, and Feb. 22, 1896; the latter, which bears the involucres, we consider the type). Also collected by Dr. Bolander at "Oakland, on slides near the bay." The few capsules that have been seen are very immature, projecting only about 1 mm. beyond the mouth of the involucre, and it is quite possible that the description of the involucre given above will need some modification on the discovery of fully ripened sporogonia.

It is practically certain that this species is, in part, at least, what Austin referred provisionally to *Anthoceros caespiticius* De Not. (Bull. Torr. Bot. Club, 6: 26 1875), drawing his description, however, "from a specimen in Herb. Torrey under the name *A. laevis* Linn., from the Island of Corsica." We had thought to take up for *A. phymatodes* the specific name *Torreyi* Aust. MS., which appears in parenthesis after *A. caespiticius* in the place cited, but an examination of the Austin collection, so generously loaned by Mr. Pearson, showed the manuscript diagnosis of *A. Torreyi* affixed to a scrap of the Corsican plant (which we refer to *Anthoceros dichotomus* Raddi) and that plant alone alluded to at the close of the description. *A. Torreyi* Aust. MS. is therefore a synonym of *A. dichotomus* and not of *A. phymatodes.* Bolander's specimen is accompanied by a slip of brown paper on which is written—evidently by himself—"Oakland on slides near the bay," but it is found in the Austin collection glued to Austin's manuscript description of *A. Lescurii* from New Orleans, the evident type of which appears in the same collection under the name of *A. Ludovicianus.*

Anthoceros phymatodes is a near ally of *A. dichotomus* Raddi, specimens of which from Raddi's herbarium we have had the privilege of examining through the kindness of Professor Massalongo, as well as specimens from Portugal and Italy, obligingly communicated by Herr Stephani. But *A. dichotomus* has a costa $1/8$–$1/3$ the width of the segment, 6–10 cells thick, the lamina mostly 2-stratose, involucre .7–1 mm. wide, often enlarged at the irregularly 2–4-lobed mouth; while *A. phymatodes* has a costa $\frac{1}{3}$–$\frac{3}{3}$ the width of the segment, 10–16 cells thick, the marginal lamina 5–3-stratose, involucre .5–.6 mm. wide, not expanded at the entire or repand mouth. To facilitate further comparison, when the mature sporogonia are found, it may be added that in *A. dichotomus* from Raddi's herbarium ("*Anthoceros polymorphus* Raddi γ *dichotomus* Raddi" is the legend the packet bears) the capsules are erect or slightly curved, 7.5–15 mm. long, often thickened toward the apex, spores yellow, becoming yellowish-brown, rounded-tetrahedral, almost wholly smooth on all faces, 42–60 μ in maximum diameter, pseudo-elaters yellowish, of 1–4 irregular elongated cells, geniculate, variously contorted, often branched.

Anthoceros caespiticius DeNot, the probable original of which (from the vicinity of Cagliari, in southern Sardinia), we have been allowed to study through the indulgence of Professor Pirotta, is not closely related to *A. dichotomus,* with which it was compared by its author. It is a near ally of *Anthoceros punctatus* and may not be specifically distinct. The spores incline to be fuscous and are finely setose-papillate on the outer face and foveolate-reticulate on the inner faces; they are 40–45 μ in maximum diameter. The pseudo-elaters are practically as in *A. punctatus*. The involucres measure .65–1.1 × .25–.5 mm. It is surely very different from the Californian plant, even though mature spores of the latter are wanting. The thallus apparently bears no tubers; it is thinner than in *A. phymatodes*, is quite indistinctly costate, and has the peculiar narrow ascending marginal shoots of *A. punctatus*. It is described by DeNotaris as being erect, while *A. phymatodes* is prostrate.

Anthoceros tuberosus Tayl., from Swan River, Australia (Drummond, 1873), we have examined through the courtesy of Dr. B. L. Robinson, Curator of the Gray Herbarium, in which the Taylor collection is incorporated. It differs from our plant in the much thinner, broader, scarcely costate thallus, the terminal or marginal tubers, and the shorter somewhat obovate involucres. The spores are yellow, becoming brownish, sparingly warty-granulose, 35–45 μ; pseudo-elaters mostly of 1 or 2 elongated geniculate cells.

Anthoceros phymatodes differs from *A. Donnellii* Aust. in the larger, less numerous tubers on stouter stalks, as indicated more definitely in our descriptions and in the key to the species, also in the thicker, more opaque thallus, with less distinct surface cells, in the longer segments, etc.

The tubers of *A. phymatodes* are formed at the apex of the costa, but their peduncles become strictly ventral in their attachment by the continued onward growth of the segment. Two or three tubers successively older and larger as one passes backward may often be seen depending from a single branch. The tuber consists of a cortex of 2-4 layers of nearly empty cells enclosing a central mass of smaller cells so densely filled with oil drops or whitish granules that the cell boundaries in a section are rendered obscure. The whitish granules in alcoholic material show a starch reaction with iodine.

6. ANTHOCEROS DONNELLII Aust. Bull. Torr. Bot. Club, 6: 304. 1879.

Thallus small, smooth, rather thin, substellately dissected, the segments irregular in form, somewhat overlapping and intertangled, light green, pellucid, broadly and sometimes indistinctly costate, bearing beneath very numerous small, pyriform or subglobose tubers, these .15–.3 mm. in diameter, on slender peduncles .25–.6 × .08–.09 mm.; major segments oblong, obcuneate, or sublinear, 2–8 × 1–2 mm., lightly canaliculate when dry, subcrenate at apex, 5–8 cells thick in middle becoming 3- or rarely 2-stratose at margin; surface-cells very distinct, protuberant, subquadrate-rhombic to oblong-pentagonal, 36–75 × 30–45 μ, the inner cells, especially toward the margin, very large and hyaline: dioicous:* involucre large, infundibuliform, incised at the mouth; capsule, spores and elaters nearly as in *A. laevis*.

"Banks of the Caloosahatchee River, southwest Florida, Mar., 1878; rare" (Austin).

Type in Herb. Pearson; duplicate in Herb. Columbia University and Herb. Underwood. Though we have had the privilege of examining all the material of this species in the three herbaria mentioned, we have found no involucre, and for that can simply copy the description of Austin. A portion of a single capsule was found lying on the thallus, but the organic connection of the two could not be determined, though there was no indication of a mixture with any other species. This bore yellow, granulose-papillate spores, 42–45 μ in maximum diameter, and elaters like those of *A. laevis*. Austin in his notes following the diagnosis describes the spores as "smooth or nearly so," but he also characterized those of *A. laevis* as "nearly smooth." †

A. Donnellii is somewhat allied to *A. dichotomus* and *A. phymatodes*, but evidently differs from both in the pellucid thallus, the very distinct surface-cells, the less elongated segments, in the smaller, more numerous tubers on shorter, narrower peduncles, springing from the region of the costa but often in groups of 3–8 and somewhat laterally distributed, and is probably different also from both in the form of the involucre and from *A. dichotomus* in the thickly granulose-papillate spores.

7. ANTHOCEROS PUNCTATUS L. Sp. Pl. 2: 1139. 1753.

Anthoceros scariosus Aust. Proc. Acad. Nat. Sci. Philad. 230. 1869.

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* The description from this point on is from the Latin of Austin's original diagnosis.

† Bull. Torr. Bot. Club, 6: 25. 1875.

Thallus rosettes rather small, 5–15 mm. in diameter, light green, more or less blackened in drying, depressed, or somewhat erect and turbinate, laciniate and undulate-crisped, often with slender ascending marginal lobes, variously lamellate-ridged, lacunose, or warty, 8–12 cells thick in median parts, becoming rather suddenly 3- or 2-stratose at periphery, sometimes indistinctly costate, here and there usually glandular-thickened with age; surface-cells distinct, protuberant, subquadrate, irregularly pentagonal or hexagonal, 45–75 × 30–45 μ, with a large angular chloroplast, the interior cells much larger, thin-walled, surrounding numerous and ample lacunae: monoicous: involucres often geminate, cylindrical, oblong-linear, 1–5 × .4–1.1 mm., sometimes lamellate, scarious now and then at the repand mouth: capsule dark brown or black, 8–60 (mostly 15–30) × .25–.45 mm., with somewhat elongated pedicel; spores black or nearly so, 35–58 μ in maximum diameter, angular, the convex face furnished with numerous (75–125) spines or 2- or 3-pointed papillae 3 μ or more in length, the plane faces foveolate-reticulate, sometimes becoming granulose-papillate near the angles; pseudo-elaters fuscous, 45–200 × 12–18 μ, of 1–4 cells, geniculate, variously contorted and inflated.

EXSICC. Hep. Bor-Am. 122; Hep. Am. 82.

On damp ground. Less common than *A. laevis*, with which it sometimes grows. Connecticut (Underwood, Evans); New York (Coville, Underwood); Ohio (Lesquereux, Werner); Tennessee (Naylor); South Carolina (Austin); Florida (J. D. Smith, Underwood); Alabama (Mohr); Louisiana (Langlois); Missouri (Demetrio); Canada (*fide* Austin).

The measurements in the above description have been drawn in part from the European *A. punctatus* of authors which is extremely variable and is thought by some to include more than one species. We have seen no American specimens with involucres longer than 4 mm. or capsules longer than 4 cm.

Anthoceros laevis is often confused with *A. punctatus* in herbaria, but the former can always be very easily distinguished from the latter when fertile and mature, by the spores; when sterile—if superficial characters are doubtful—by the absence of lacunae within the thallus, which in *A. punctatus* are large and numerous.

8. ANTHOCEROS FUSIFORMIS Aust. Bull. Torr. Bot. Club, 6: 28. 1875.

Thallus in depressed rosettes 6–20 mm. in diameter, or often suberect and caespitose, in tufts 5–20 mm. deep, thick and rather rigid, opaque and blackened when dry, undulate-crisped, deeply and irregularly dissected, ecostate, cavernose within, 10–25 cells thick in median parts, becoming rather abruptly 3- or 2-stratose at margin, often with large and abundant glandular-thickenings, more or less lamellate-cristate, lacunose, the lamellae sometimes broad and leaf-like; surface-cells somewhat distinct, subquadrate to oblong-hexagonal, 30–75 × 18–40 μ, with large chloroplast, inner cells much broader and longer in axile and basal parts, but often scarcely larger toward the growing apices: monoicous: antheridia in groups of 2–4: involucres often numerous and crowded, but very rarely with the bases united in pairs, subfusiform or narrowly cylindrical, often curved, 2–9 × .35–1.2 mm., smooth, furrowed, or rarely lamellate, mouth repand or scarious and erose-lacerate: capsule dusky brown to black, 2–9 cm. (mostly 3–6 cm.) × .25–.5 mm., rather long-pedicellate, valves commonly a little twisted on drying, stomata abundant, the guard-cells nearly colorless; spores dark brown or black, 45–63 μ in maximum diameter, angular, the convex face with very numerous (125–225) spines or papillae less than 3 μ in length, plane faces granulose-papillate or sinuate-foveolate; pseudo-elaters fuscous, 60–250 × 8–14 μ, of 1–4 cells, geniculate and variously contorted, sometimes branched.

EXSICC. Hep. Am. 163.

On moist banks. Common on the Pacific coast from southern California to British Columbia.

A. fusiformis is a close ally of *A. punctatus*, differing in the larger, thicker, more dissected, and usually more lamellate-cristate thallus, the rarely geminate, often longer involucres, the longer capsules, the rather larger, more minutely and thickly echinulate or papillate spores, and in the longer, narrower elaters. In the southern part of California it makes its nearest approach to *A. punctatus*, but may be distinguished from that species after a little experience by the characters of the spores and elaters. The involucres in the Californian plants are rarely more than 5 mm. long. *A. fusiformis* ripens its spores in California in April and May, at which time the thallus has commonly become shriveled and inconspicuous.

Following Austin's original description of *Anthoceros fusiformis* three specimens are cited, as follows: "Observation [Observatory] Inlet, Columbia, Dr. Scouler in Herb. Torrey; also in Herb. Taylor. California, Bolander. Oregon, E. Hall." What appear to be these three originals are preserved in Herb. Pearson. Hall's specimen is marked "R. Mts., Hall," but this manner of giving the habitat of Hall's Oregon Hepaticae is observed elsewhere in the Austin collection.

ANTHOCEROS FUSIFORMIS STOMATIFER (Aust.).

Anthoceros stomatifer Aust. Bull. Torr. Bot. Club, 6: 28. 1875.

Capsule slender, 4–9 cm. × .25–.4 mm., black, the valves much twisted in drying; spines of the spores sometimes exceeding 3 μ in length; pseudo-elaters rather broader.

Oregon and northward.

A. fusiformis stomatifer is, in some respects, intermediate between *A. fusiformis* and *A. punctatus.* It seems to have nothing in thallus, involucre, or number of stomata on the capsule-wall, to distinguish it from *A. fusiformis;* and is scarcely distinguishable from *A. punctatus* except by the longer, narrower involucre, the longer capsule, more twisted valves, and the rather larger spores with much more abundant spines. Intergrades perfectly with the genuine *A. fusiformis.* The probable type of *A. stomatifer* Aust., marked "Rocky Mts., Hall" is in Herb. Pearson.

9. ANTHOCEROS RAVENELII Aust. Bull. Torr. Bot. Club, 6: 28. 1875.

Anthoceros Lescurii Aust. *l. c.* 6: 28.

Anthoceros Joorii Aust. *l. c.* 6: 29.

Anthoceros Olneyi Aust. *l. c.* 6: 29.

Thallus suborbicular, 6–16 mm. broad, light green, blackening with age, more or less rugose and foveolate, sometimes verrucose-punctate and lamellate, laciniate or subradiately dissected, with oblong-flabelliform, crenate or variously lobed, occasionally suberect segments, 8–15 cells thick in axile parts, 3-stratose at margin, with internal lacunae; surface-cells somewhat distinct, subquadrate, oblong, or pentagonal, 25–50 × 18–30 μ, with rather small chloroplast: monoicous: involucres frequently geminate, short-cylindrical, .8–2.5 × .4–1 mm., smooth or lightly striate, usually a little dilated toward the truncate, crenate or repand-dentate, often narrowly scarious mouth: capsule fuscous, clavate-cylindrical, 8–20 × .3–.8 mm., thick-walled, with numerous stomata, the valves slightly flexuous; columella often at first strongly appendiculate, becoming naked; spores scarcely angled, black or fuscous, 70–100 μ in maximum diameter, covered throughout with very numerous short blunt papillae, these sometimes confluent into vermicular anastomosing lines; sterile cells dusky brown, ellipsoidal, globose, or subcubical, usually shriveled, mostly separate but sometimes forming catenulate groups or variously adherent.

On moist earth. South Carolina (Ravenel, Austin); Florida (Chapman, Austin); Alabama (Mohr); Louisiana (Joor, *fide* Austin, Langlois, no. 395, *p. p.*).

Type in Herb. Pearson; duplicate in Herb. Columbia University.

The spores in *A. Ravenelii* show considerable variation in their markings, from anastomose-reticulate ridges to separate papillae, but we have observed quite wide extremes in respect to this character even in different parts of a single capsule. Yet the papillae are less commonly reduced to reticulate lines in the Louisiana and Alabama specimens than in those from South Carolina and Florida.

Anthoceros Lescurii and *A. Joorii* were retracted by Austin himself four years after their proposal,* these being considered mature conditions of *A. Ravenelii*, which was originally described from immature material. In *A. Olneyi* Aust., the erectness of the frond appears in all the specimens we have seen to be due largely to the way the plant is glued and pressed to the mounting paper. The "large, black, globular, tuberculated granules just beneath the surface of the frond," for which *A. Olneyi* is chiefly remarkable, are spore-masses or possibly undeveloped perithecia belonging to a peculiar endophytic fungus. The thallus is permeated with colorless or light-brown septate hyphae at the ends of lateral branches of which are formed globular clusters, 25–45 μ in diameter, each composed of numerous dark, smoothed-walled cells, measuring 6–10 μ. The fungus bears some superficial resemblance to certain of the Tilletiaceae. The same parasite occurs also in specimens of *A. Ravenelii* from Mobile, Ala. (Mohr), and, occasionally also, the same or a very similar one in *A. Hallii* from Seattle, Washington (Hep. Am. 162).

10. ANTHOCEROS MACOUNII sp. nov.

Thallus forming small dark green rosettes, 4–10 mm., in diameter, strongly undulate-crisped, subradiately inciso-laciniate or somewhat broadly lobed, rugose, pitted, sometimes slightly lamellate, ecostate, 6–8 cells thick in axile parts, cavernose, becoming at the margin gradually 3- or 2-stratose, now and then glandular-thickened; surface-cells distinct, translucent, lightly protuberant, subrhombic, trapezoidal, or oblong-pentagonal, 35–75 × 30–35 μ; *Nostoc* colonies spherical: monoicous: antheridia in groups of 3 or 4: involucres short, sometimes united in pairs, cylindrical-oblong, or by contraction at base and mouth, dolioform or subglobose, .85–1.25 × .5–.9 mm., incrassate except at the thin erose or subentire mouth: capsule black, erect or a little curved, 3–6 × .3–.5 mm., thick-walled, with numerous stomata, the valves rigid or slightly flexuous when dry, brittle and often broken; columella sometimes appendiculate; spores fuscous or black, rounded-tetrahedral, densely and rather minutely muriculate on both the inner and outer faces, 48–65 μ in maximum diameter; sterile cells short, nearly as broad as long, without spiral thickenings, separate or variously adherent, often shriveled and inconspicuous. (Plate 326.)

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* Bull. Torr. Bot. Club, 6: 305. 1879.

EXSICC. Can. Hep. 81 (as *A. punctatus*).

"Abundant on earth subject to inundation at the outlet of Leamy's Lake, near Hull, Quebec, 6th October, 1889" (Macoun).

Anthoceros Macounii is allied to *A. Ravenelii* Aust., from which it is clearly distinct in the shorter capsule, in the much smaller, more angular spores, with the short papillae mostly separate, never (in the specimens seen), passing into vermicular anastomosing lines, and in the more fragmentary, less abundant sterile cells. Distinguished at once from *A. punctatus* by the short capsules, the mostly larger, merely muriculate, not echinulate or setose-papillate spores, and by the reduced abortive sterile cells; the spores, too, in *A. Macounii* are almost uniformly roughened over the entire surface, while in *A. punctatus* the inner faces of the spores are nearly always simply foveolate-reticulate.

NOTOTHYLAS Sulliv. Musc. Allegh. [Exsicc.] nos. 289 and 290, with diagnosis. 1845. Id. [Reprint of tickets] 69. 1846.

[CARPOBOLUS Schwein. Jour. Philad. Acad. 2: 361. 1822. Not Adans. Fam. 2: 8. 1763.]

[CARPOLIPUM Nees, G. L. N. Syn. Hep., 591. 1846.]

Thallus orbicular, laciniate, or with broad, rounded, crenulate-incised lobes, ecostate, of more than one layer of cells throughout.

Monoicous. Sporogonia chiefly marginal, but becoming now and then dorsal, wholly or for the greater part enclosed within the involucre, suberect or horizontal-deflexed. Capsule short, oblong-sphaeroidal to elongate-cylindrical, bivalved or opening irregularly, without stomata; columella sometimes early disintegrated and obscure; spores often nearly smooth; sterile cells single or irregularly adherent, hyaline, nearly cubical, usually with traces of spiral thickenings.

Key to the Species.

Spores smooth or nearly so.	1. *N. orbicularis.*
Spores muriculate, at maturity fuscous or nearly black.	2. *N. Breutelii.*

1. NOTOTHYLAS ORBICULARIS (Schwein.) Sulliv. Musc. Allegh. [Exsicc.] subjoined to no. 290. 1845.

Targionia orbicularis Schwein. Spec. Fl. Am. Sept. Crypt. 23. 1821.

Carpobolus orbicularis Schwein. Jour. Philad. Acad. 2: 370. *pl., f. II.* 1822.

Notothylas valvata Sulliv. Musc. Allegh. [Exsicc.] 289. 1845.

Notothylas melanospora Sulliv. l.c. 290.

Thallus forming flat, often confluent rosettes 5–16 mm. in diameter, deeply lobed, undulate-crisped, often with narrow ascending marginal laciniae, ridged and pitted but scarcely lamellate, 4–8 (rarely 12) cells thick in axile parts, with large lacunae, becoming sometimes widely 3- or 2-stratose toward the margin; surface-cells distinct, protuberant, quadrate, rhombic, or oblong-hexagonal, 40–145 × 30–40 μ: involucres commonly at the marginal sinuses, becoming sometimes distinctly dorsal, often geminate, corniform, horizontal-deflexed, more rarely suberect: capsule widening a little below the middle, ovate- or oblong-cylindrical, occasionally oblong-ovoid, .75–3.25 × .35–.65 mm., with or without distinct lateral sutures, bivalved or opening irregularly, the exterior cells oblong or irregularly quadrate, usually very thick-walled, those bordering the valves yellowish-brown and more solid; columella often fuscous and appendiculate; spores rounded-tetrahedral, 36–50 μ in maximum diameter, yellow, becoming at times nearly black, smooth or very obscurely roughened on the convex face; sterile cells difform, mostly single and subcubical, with rudiments of spiral thickenings.

EXSICC. Musc. Allegh. 289, 290; Hep. Bor-Am. 124, 125; Hep. Am. 65.

On moist soil. North Carolina (Schweinitz); Virginia (Underwood); Delaware (Commons); Pennsylvania (James); New Jersey (Austin); Connecticut (Underwood); Massachusetts (Underwood and Seymour); Ohio (Sullivant, Lesquereux); Indiana (Underwood).

Type in Herb. Schweinitz in possession of the Philadelphia Academy of Natural Sciences.

The color and size of the spores and the appendiculate columella—characters which were emphasized by Sullivant in distinguishing *Notothylas melanospora* and *N. valvata*, are seen from a study of the specimens now accessible to afford little or no basis for a specific separation. Of greater constancy, perhaps, in comparing the forms that we have included under *N. orbicularis*, are the length of the capsule, the texture of its outer wall, and the presence or absence of sutures, yet these, we believe, are matters of vigor and perfection in development rather than of specific significance. Capsules that project well beyond the involucre seem invariably to exhibit well defined sutures and to have very thick-walled, usually oblong, cells on the surface, while those that ripen wholly enclosed in the involucre, on the same plant, sometimes, have only rudimentary sutures or none at all and show comparatively thin-walled, often irregularly quadrate, surface-cells. Sullivant seems to have proposed *N. melanospora* with some hesitation, and Spruce* has placed on record his doubt as to its distinctness. *N. valvata* Sulliv., as is well known to American hepaticologists, was first reduced by Austin. The spores in *N. orbicularis* occasionally undergo quite a remarkable change of color in the ripening, being sometimes almost black in the upper part of the capsule while bright yellow below. The change appears to be quite different in nature from that in *Anthoceros punctatus* and its allies, in which there is in the earlier stages no yellow but a dusky tinge, this being simply intensified in the process of maturing.

2. NOTOTHYLAS BREUTELII (Gottsche) Gottsche Bot. Zeit. 16: 21 (Anhang). 1858.

Anthoceros Breutelii Gottsche, G. L. N. Syn. Hep. 583. 1846.

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* Hepaticae of the Amazon and Andes, 578. 1885.

Thallus rosettes mostly broad and flat, 10–20 mm. in diameter, reticulate or nearly smooth, 4 or 5 cells thick in median parts, with lacunae, but chiefly 3- or 2-stratose, subradiately cleft, the lobes commonly broad, rounded, denticulate or slightly crenulate-incised at margin; surface-cells irregular and indistinct: involucres corniform, marginal or often becoming widely dorsal, horizontal or ascending: capsules ovate- or oblong-cylindrical, 1.5–3 mm. long, bivalved, the exterior cells thick-walled, those bordering the valves yellowish-brown; columella early disintegrated; spores at first yellow, becoming fuscous or nearly black at maturity, 36–48 μ in maximum diameter, muriculate on the convex face.

In an old ditch, Pointe à la Hache, Louisiana, (Rev. A. B. Langlois, no. 85).

The thallus in the Louisiana plant is rather broader and less incised than in a Cuban specimen collected by Wright and said to have been determined by Gottsche, but the agreement in characters of capsule and spores is very close. It may be remarked that the spores of *N. orbicularis* are sometimes obscurely tuberculate or papillate on the convex face, but this roughening in *N. Breutelii* is much more pronounced.

Explanation of Plates.

Plate 321. *Anthoceros Carolinianus occidentalis* M. A. Howe.

1 and 2. Portions of the thallus, natural size.

3–5. Involucres, × 12.

6. Segment of thallus with marginal glandular-thickening, × 6.

7. Transverse section of thallus segment (showing but one-half the width), × 23

8. Spores, × 305.

9. Pseudo-elaters, × 225

All drawn from specimens collected in California; Figs. 1–3, 8 and 9, Olema, Marin Co. (Mr. W. L. Jepson); 4 and 6, Twin Oaks, San Diego Co. (Mr. F. W. Koch); 5, Howell Mountain, Napa Co. (Prof. W. A. Setchell); 7, Mt. Tamalpais, Marin Co.

Plates 322 and 323. *Anthoceros Pearsoni* M. A. Howe.

1. Segment of the thallus, with mature sporogonia, natural size.

2, 3 and 4. Portions of a sterile thallus, showing its form, manner of branching and the beginnings of the marginal glandular-thickenings, natural size.

5. Marginal glandular-thickenings, fully developed, × 12.

6 and 7. Thallus segments with younger, sometimes peduncled, glandular-thickenings, × 12.

8. Ventral view, showing glandular-thickening bearing root-hairs, × 12.

9 and 10. Longitudinal sections through well developed glandular-thickenings, the latter exhibiting embedded antheridia, × 53.

11. Transverse section of margin of the thallus, × 53.

12. Median longitudinal section of the thallus, × 53.

13–15. Involucres, × 12.

16. Pseudo-elaters, × 225.

17. Spores, × 305.

All figures of *A. Pearsoni* from Californian material; 1, 13, 16 and 17, Mill Valley, Marin Co. (the type); 2–4, near Duncan's Mills, Sonoma Co. (no. 1200) 5, 9, 10, 14 and 15, near Mendocino (no. 702); 6 and 7, Cazadero, Sonoma Co. (no. 1199); 8, Palo Alto (Prof. D. H. Campbell); 11 and 12, Mill Valley, Feb. 22, 1896.

Plates 324 and 325. *Anthoceros phymatodes* M. A. Howe.

1. Portion of the thallus, natural size.

2. Ventral view of a thallus segment, showing costa and tuber, × 23.

3–6. Lateral views of thallus segments, showing form and stages of development of tubers, × 23.

7 and 8. Old tubers, showing vegetative propagation by sprouting, × 23.

9. Longitudinal section through costa and young tuber, × 47.

10. Longitudinal section showing early stages in the formation of the tuber, × 47. The section is somewhat oblique and does not exhibit the full thickness of the costa.

11. Section through a well-grown tuber, × 53.

12. A single interior cell from fig. 11, × 305.

13. Longitudinal section through the costa, × 53.

14 and 15. Transverse sections of thallus segments, × 53.

16. Outlines of two other transverse sections of thallus segments, × 23.

17. Involucres, × 12.

Figs. 1–6 and 9–17 from specimen collected in Mill Valley, Marin Co, California. February 22, 1896—mostly drawn from material fixed with 1% chromic acid and preserved in alcohol; 7 and 8, from same locality, March 19, 1892.

18. Involucre of *Anthoceros polymorphus* Raddi, γ *dichotomus* Raddi, ex herb. Raddi, × 12.

Plate 326. *Anthoceros Macounii* M. A. Howe.

1. Portion of thallus with involucres and sporogonia, × 12.

2. Capsules after dehiscence, × 12.

3. Involucres, × 12. The capsules of *A. Macounii* appear to be very brittle; in this fragment they were found broken off at the mouth of the involucres as indicated in the figure.

4. Involucre and capsule with a broken valve, × 12.

5. and 6. Involucres and broken capsules, × 12.

7. Stoma from surface of capsule, × 305.

8. Columella, × 53.

9. Spores and pseudo-elaters, × 305.

All the above figures from Can. Hep. 81.

10. Spores of *Anthoceros punctatus* L. from Hep. Bor-Am. 122, × 305. Introduced for comparison.

DEPARTMENT OF BOTANY, COLUMBIA UNIVERSITY,
January 7, 1898.

The Evolution of Assimilating Tissue in Sporophytes.

By Carlton C. Curtis.

In *Harper's Magazine* for November appears an article by Dr. H. S. Williams on the "Century's Progress in Biology." The author very justly ascribes an important place to the poet Goethe, whose treatise on the metamorphosis of plants, however fanciful the dream, it must be admitted, suggested lines of investigation which have yielded such important results in every department of botany, originating the study of the history of development and paving the way for the spread of the idea of the transmutation of species. The absurd speculations of the philosophy of Goethe and of his time have passed away; still his doctrine of leaf metamorphosis, though not originating with him more than with Cesalpino and Linnaeus, has been generally accepted. Goethe's ideal or typical plant with its six stages of development, cotyledon, leaf, sepal, petal, stamen and corolla, appearing in three wave crests or expansions, (leaf, petal and carpel), and three wave troughs or contractions (cotyledon, sepal and stamen) has had in the popular mind something more substantial in its conception than the stuff of which dreams are made. At the present time these organs are quite generally regarded as due to the gradual metamorphosis in acropetal succession of parts which are identical in origin; and, though not ascribing the change to the clarification and refinement of the ascending sap, we have come to look upon the metamorphosis as a progressive one from primordial leaf to carpel. As a matter of fact, however, there is probably no evidence of the metamorphosis of a leaf into any member of the flower, especially into one of the essential parts. The evolution of plant types points to an entirely distinct origin of the organs of assimilation and propagation and indicates very clearly the priority of the latter in point of time. Among lower forms, as the Algae, when an alternation can be traced, there is no indication of assimilatory tissue in the sporophyte, it being simply a sporangium. This is essentially true of the lower Hepaticae, as in *Riccia*, the fertilized egg of the archegonium is developed as a sporangium surrounded by a single layer of non-propagative cells. In the higher members of this group a more considerable sterilization of tissue is apparent in the formation of elaters and a rudimentary seta. This differentiation is carried further in the sporogonia of the Jungermaniales, and among the Anthocerotales a most suggestive distribution of labor is manifest in the differentiation of the sterile cells. The central cell mass is no longer propagative and supports a mere bell-shaped zone of archesporial tissue which is associated with assimilatory cells; the foot has developed root-like processes for the absorption of nutriment from the gametophyte, and among some forms it is especially noteworthy that certain parts of the archesporial tissue becomes sterile, separating the sporogenous tissue into irregular chambers. These features are worthy of especial consideration, for in them are seen the rudiments of the segmentations and differentiations of the higher plants. It will be seen that the entire sporogenous tissue has been advanced to near the surface of the sporogonium as a more advantageous position for the distribution of spores and an assimilatory tissue has been evolved to meet the demands made upon the plant by its ever-increasing spore production, as it advances in the biological series, and finally organs for the absorption of food, both liquid and gaseous, have been added. Thus we have a rudimentary sporophytic plant, still parasitic to be sure, but possessing three distinct functions, progagation, assimilation and absorption, and from some such type there is indication of the evolution of the higher plants.

The Musci are remotely connected with this ancestral form and show few departures, save in the gradual sterilization of the upper portion of the archesporium, but in passing to the Pteridophyta, we are confronted by a greater gap than appears between any of the other subkingdoms. So extensive has been the obliteration of the progenitors of this division in the evolutionary series, that not only is the ancestry in doubt, but the alliances of the three surviving classes themselves must remain an uncertainty. However, the lines along which the evolution took place, as well as the origin of new features, are generally manifest. The significant features of the Pteridophyta are the finally complete separation of the two generations, the separation of the sporogenous tissue into isolated portions (sporangia) and the development of appendages, lateral organs, from the sporophyte. This has been made possible through the differentiation of tissue that accompanied the perpetuation of the physiological distribution of labor noted above. The sporophyte has become a self-supporting plant, save in its embryological condition, through the perfection of its absorbtive parts and also through the formation of appendages to which are confined almost entirely the assimilatory function. These appendages, the leaves, doubtless came about in some of the classes through their ceasing to function as organs of propagation, but retaining the function of assimilation, and in other cases they may quite as reasonably be supposed to represent outgrowths of the assimilatory tissue of the sporogonial prototype. This increase of the vegetative system of the sporophyte, which renders the approach to the Pteridophyta so striking, has become a necessity since now the food absorbed is no longer organized, and more especially in order to mature the spore, the production of which reaches its culmination in this group. The stages in this evolution of the extant Pteridophyta have been hopelessly lost, but each of the subclasses presents features that suggest an anthocerotal progenitor. This relationship appears very manifest among some of the simpler of the eusporangiate Filicinae. In this primitive group appear several strong ancestral characters, and among the more significant, as appertaining to this subject, may be mentioned the structure of the so-called fertile leaf. Here is found a superficial archesporium, made septate by the sterilization of its tissue, and associated are assimilating cells and stomata—practically the duplicate of the sporogonium of *Notothylas* and *Anthoceros*. The assimilatory portion cannot longer for lack of room be confined to the propagative organ, and is developed from it, forming an appendage, the leaf, just as the root has taken on new characters. Through forms like *Botrychium*, *Danaea* and *Angiopteris* is presented a series of changes which are suggestive of the changes which led the way to the gradual separation of the sporogenous tissue into separate portions, sporangia, and their distribution over the surface of the leaf. Thus in *Anthoceros* the sporogenous tissue is imperfectly separated forming a synangium, in *Botrychium* this septation of the propagative cells is carried further by the growth of the fertile branch into a paniculate cluster of lateral appendages, in *Danaea* this expansion assumes a leaf form with the synangia covering its entire under surface and in *Angiopteris* we see the separation of the synangia into soral groups of sporangia. In the entire class of Filicinae the complete separation of the sporogenous and assimilatory function does not seem to be perfected, and in many of those species, where the propagative tissue is confined to special leaves, the ease with which they may, in many cases, be transformed to organs of assimilation would seem to indicate the transmission of an inherited tendency towards the association of these two functions.

The Equisetinae and Lycopodinae show only the remotest alliance with the Filicinae. In the former class the separation of the sporogenous and assimilation tissues has become complete, and this is true to a large degree among the Lycopods. In both groups the aggregation of the archesporial tissue about a sterile tissue, as shown in the fertile spike, is suggestive of the apical portion of a sporogonium and the development of organs to bear the sporangia recalls the trend of morphological variation, noted among the Filicinae.

This separation of function reappears essentially unaltered among the Gymnospermae and Angiospermae and the distribution of labor has now become so thoroughly relegated to certain organs as to allow the leaves a wider range of morphological variation than was possible when associated with the propagative function when the tendency to variation might have so seriously interfered with the propagative function as to have jeopardized the perpetuation of the species. The ancestral characters are still preserved in the cone and spike with their prolific spore formation, but with the advantages accruing from the aggregating of the staminate and carpellary sporophyls on a single axis as well as from the wide range of morphological variation that appertained to both the leaf and sporophyl there appears a conspicuous reduction of sporogenous tissue in approaching the highest order. Whatever view may be held as to the development of the leaf from the sporogonium, certainly it must be admitted that the sporophyls have not resulted from a metamorphosis of leaves and that essentially the reverse process has attended the evolution of plant forms. Regarding the relation of the perianth to the other appendages the ready metamorphosis of the stamens of the Rosaceae, Nympheaceae and Ranunculaceae to petaloid structures present interesting examples that indicate that the corolla, at least, may have resulted from the sterilization of sporogenous tissue, and this seems the more probable when we associate the reduction of the essential organs of the flower with the advent of the perianth. The question may properly be asked to what category do the assimilatory appendages of the mosses belong. Physiologically they are leaves and their origin, though on an antithetic generation, is doubtless due to eruptions of the shoot brought about possibly, in some cases, through food accumulations which become a hereditary character in some plants and a fruitful source of variation, and especially has the stimulus of light been a potent factor in the development of assimilatory organs. As indicated above, a similar cause may have given rise to the leaf of the vascular plants, as is possibly true among the Filicinae, but the reduced leaf character of the Equisetinae and Lycopodinae, together with the abortion of the sporangia, certainly suggests their derivation from sterilized sporophyls. Schwendener's conception of a leaf as a lateral appendage of the shoot that differs from it in character rather than grade or rank is an excellent definition, but the failure to regard the homologies and phylogeny of these lateral organs has led to the serious misconceptions regarding morphologies so commonly recurring in text-books of botany.

Studies in the Asclepiadaceae.—II.

By Anna Murray Vail.

I.—A REVISION OF THE GENUS ACERATES IN THE UNITED STATES.

The genus Acerates was first established by Elliott, in 1817, and based on the species now known under the name of *Acerates Floridana* (Lam.) Hitchcock, but the author doubts at the same time whether the absence of the horn-like appendage constitutes a sufficient character to separate it from *Asclepias.*

In 1834 Nuttall named the genus *Polyotus*, claiming that the name *Acerates* had been already used for another genus and includes in it four species. Rafinesque treated the genus variously in 1836, but altogether too vaguely to be noticed seriously. Since then the species have been transferred from one genus to another. Bentham and Hooker placed them with *Anantherix* under *Gomphocarpus* and in the Kew Index they are so indicated. In K. Schumann's revision of the Family in Engler and Prantl's *Natürlichen Pflanzenfamilien*, it is included with *Otaria* Kunth and *Anantherix* Nutt. in the genus *Asclepias.*

Dr. Gray, in his several studies of the North American *Asclepiads*, kept *Acerates* distinct, which seems in every way the most satisfactory and logical thing to do. The following description of the genus is enlarged to include that anomalous and much discussed species, *Asclepias stenophylla*, and a new species, *Acerates Rusbyi*, which seem to be the connecting links between the genera with horned hoods and those with unappendaged hoods.

ACERATES Elliott, Bot. S. Car. & Ga., 1: 316. 1817.
[POLYOTUS Nutt. Trans. Am. Phil. Soc. 5: 199. 1834.]
[* OLIGORON Raf. New Fl. Am. 4: 60. 1836.]

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* Acerotis Raf., 1817, in New Fl. Am. 1: 49, 1836, is given as a synonym of *Acerates* and is there changed to *Otanema.* In New Fl. 4: 60, 1836, *Oligoron* is also made synonymous with *Acerates* and includes two species; one of which is probably *Acerates Floridana* in part; the other species *O. tenuifolium* might possibly refer to *Acerates auriculata* Engelm. The genus *Otanema* Raf. l. c. 4: 61, apparently refers to forms of *Acerates viridiflora.* I do not know the 1817 reference to *Acerotis.*

[OTANEMA Raf. l. c. 61. 1836.]

Erect or procumbent perennial herbs. Stems simple or branched. Leaves opposite, alternate or scattered. Inflorescence umbelliform, sessile or peduncled, terminal and lateral, several to many-flowered. Peduncles subtended by numerous involucral bracts. Flowers greenish or occasionally purplish-tinged. Calyx small, 5-parted, the segments acute, usually bi-glandulose at the sinus. Corolla rotate, deeply 5-parted, the segments small, reflexed in anthesis. Column very short, not always apparent, with commonly 5–10 small glands or processes alternating with the anther-wings. Hoods mostly attached over the whole of the column, erect, equalling or shorter than the anthers, involute-concave and somewhat pitcher-shaped, often pendulous and saccate at the base, entire, emarginate or 2–3-lobed or toothed at the apex, the ventral margins spreading towards the base into broad auricles or small infolded concealed lobes, either destitute of horns or crests or in two species with rudimentary ones. Anther-wings angulate about or somewhat below the middle, narrowed and rounded towards the base or rarely of the same width from the apex downwards, entire or notched. Follicles on erect or recurving pedicels. Otherwise as in *Asclepias.*

Seven species are known from the United States and three more are said by Eugène Fournier (Ann. Sci. Nat. Ser. 6, 14: 386. 1882.) to occur in Mexico.

Key to the Species.

Auricles of the hood when present concealed within.
Umbel solitary, terminal. 1. *A. lanuginosa.*
Umbels several, lateral, (in no. 2 occasionally terminal).
Hoods rounded, much shorter than the anthers, entire at the summit.
2. *A. Floridana.*
Hoods entire, rounded or acutish at the summit, as high as the anthers.
3. *A. viridiflora.*
Hoods 2-parted at the summit, the divisions lanceolate.
4. *A. bifida.*
Auricles of the hood conspicuously spreading; umbels lateral.
Hoods emarginate or truncate at the summit, crestless within.
5. *A. auriculata.*
Hoods 3-lobed at the summit, with an internal crest-like midrib, terminating in the middle lobe. 6. *A. angustifolia.*
Hoods truncate and entire at the summit, with an obscure, thin horn attached to the keel of the hood and nearly reaching its apex.
7. *A. Rusbyi.*

1. ACERATES LANUGINOSA (Nutt.) Dec.; DC. Prodr. **8**: 523. 1844.

Asclepias lanuginosa Nutt. Gen. **1**: 168. 3 Ap. 1818. Not H.B.K. 1818.

Asclepias Nuttalliana Torr. Ann. Lyc. N. Y. **2**: 218. 1828. Not A. Gray, Man. Ed. 2, 352 and 704. 1856.

Polyotus lanuginosus Nutt. Trans. Am. Phil. Soc. **5**: 200. 1834.

Acerates monocephala Lapham; A. Gray, Man. Ed. **2**: 704. 1856.

Hirsute-pubescent throughout with weak spreading hairs. Stems erect, angled, 1-3 dm. high; leaves opposite or some of them alternate and scattered, very short-petioled, oblong-ovate to lanceolate, 4–7 cm. long, obtuse or acutish or sometimes with a rounded base; umbel terminal, solitary, mostly many-flowered; corolla greenish, the segments 4 mm. long; column obsolete; hoods shorter than the anther-wings, oblong, almost petaloid, entire, solid up the base of the anther-wings, the obtuse apex sometimes recurved backwards, the ventral margins infolded with a small concealed auricle toward the base; accessory processes small, obtuse; pollinia 1.2 mm. long, attenuate upwards; anther-wings salient and obtusely angled towards the base, entire; follicles on recurving pedicels. Mature fruit not seen.

Prairies, Wisconsin and Northern Illinois to Missouri at White River (Nuttall); Yellowstone (Allen); "On the Canadian" (James). Summer.

Illustration: Britt. & Brown, Ill. Fl. **3**; *f. 2928.* 1898. Ined.

2. ACERATES FLORIDANA (Lam.) A. S. Hitchcock, Trans. St. Louis Acad. **5**: 508. 1891.

Asclepias Floridana Lam. Encycl. **1**: 284. 1783.

Asclepias incarnata Walt. Fl. Car. 106. 1788. Not. L. 1753.

Acerates longifolia Ell. Bot. S. C. & Ga. **1**: 317. 1817.

Polyotus longifolius Nutt. Trans. Am. Phil. Soc., Ser. 2, **5**: 200. 1834.

Oligoron longifolium Raf. New Fl. Am. **4**: 60. 1836. ?

Minutely scabrous-pubescent, becoming glabrate. Stems erect or ascending, 3–8 dm. high or more; leaves linear to elongated linear-lanceolate, 7–16 cm. long, 3–1.5 cm. wide; umbels 2 or 3-several, usually many-flowered; peduncles 5 mm. to 4 cm. long; pedicels slender, 1–1.3 cm. long; corolla-segments oblong, about 3 mm. long, dull purple on the outer surface; hoods purplish, oval, obtuse, slightly pendulous at the base, ventral margins entire, adnate at the base to the upper part of the distinct column, rising to about the middle of the anthers; anther-wings angled at the middle, tapering to the longer base; follicles erect on recurved fruiting pedicels, fusiform, 7–10 cm. long, minutely puberulent; seeds 7 mm. long; coma 3–4 cm. long.

Prairies and wet pine barrens and swamps, Wisconsin and Ohio to Florida and Texas. June to September.

Very variable as to height, width and length of foliage, and also length of peduncles. The Florida form has a more distinctly terminal inflorescence and longer peduncles. A specimen from Louisiana with lanceolate leaves has peduncles 5–7 cm. long, and was collected by Dr. Ingalls at New Orleans in 1834. The Western form has sessile or very short peduncled umbels and more truly lateral inflorescence. There seem to be, however, no differences in the flowers.

Illustration: Britt. & Brown, Ill. Fl. 3: *f. 2926.* 1898. Ined.

Michigan: Mr. Wright. 1838. *Illinois:* Dr. Scannon; Winnebago Co., M. S. Bebb, 1871; Hillsgrove, Holton, 1850. *Missouri:* St. Louis, Engelm.; Jasper Co., B. F. Bush, no. 244, 1893. *Arkansas:* Nuttall. *South Carolina:* St. John's, Porcher. *Georgia:* Darien Junction, McIntosh Co., J. K. Small, 1895. *Louisiana:* Alexandria, Hale. *Florida:* St. Marks, Rugel, 1843; St. Augustine, Miss Reynolds, 1877; Chapman.

3. ACERATES VIRIDIFLORA (Raf.) Eaton, Man. Ed. 5, 90. 1829.

Asclepias viridiflora Raf. Med. Rep. (2) 5: 360. 1808.

Polyotus heterophyllus Nutt. Trans. Am. Phil. Soc. 5: 199. 1834.

Tomentose-puberulent, becoming glabrate. Stems ascending, 2–6 dm. high, often procumbent; leaves opposite or some of them scattered, short-petioled, 4–6 cm. long, oval or oblong, obtuse and retuse or acutish, usually mucronate, sometimes with undulate margins, becoming thick and coriaceous; umbels globose, sessile or nearly so, 2–5 or more, lateral, densely many-flowered; pedicels 1 cm. long or less; corolla-segments oblong-lanceolate, about 5 mm. long; hoods inserted over the whole short column, dull purplish, or at least tinged with purple, erect, nearly equalling the anthers, lanceolate-oblong, entire, except for a pair of small infolded and concealed auricles at the base; accessory processes 5; anther-wings salient above the middle, semi-rhomboid, entire, or possibly obscurely notched, tapering toward the base; pollinia 2–5 mm. long, attenuated to the short caudicles; follicles

6–10 cm. long, erect on recurved pedicles, fusiform, attenuate, glabrous or minutely puberulent; seeds 7 mm. long; coma 2.5–3 cm. long. Very variable and intergrading with the two varieties.

Dry and sterile soil, New England to Saskatchewan, southward to Florida, Texas, New Mexico and North Mexico. June to September.

Illustrations: Torr. Fl. N. Y. 2: *pl. 88.* 1843. In part. Hook, Fl. Bor. Am. 2: *pl. 143.* 1844. In part. Britt. & Brown, Ill. Fl. 3; *f. 2924.* 1898. Ined.

Forms with broadly oval or oblong, obtuse or retuse leaves.

New York: Torrey; Staten Island, T. H. Kearney, Jr. *Pennsylvania:* Conewago Co., Small, 1889. *Georgia:* Boykin; Gwinnett Co., Small, 1893. *Texas:* Kerrville, Heller, no. 1913, 1894. *New Mexico:* Wright, no. 1693. In part.

Forms with broadly oblong, acute or acutish leaves.

Nebraska: Wilcox, 1888; Banner Co., Rydberg, no. 231, 1891. *Kansas:* Fort Riley, E. E. Gayle, 1892; Osborne Co., C. L. Shear, no. 102. 1894. *Illinois:* Augusta, S. B. Mead, no. 1043. *Arkansas:* Nuttall. *North Carolina:* Rowan Co., Heller, no. 125. 1890. *Florida:* Marianna, Chapman. *Louisiana:* Alexandria, Hale; Carpenter, no. 43. *Texas:* San Diego, Miss Croft.

ACERATES VIRIDIFLORA IVESII Britt., Mem. Torr. Club, 5: 265. 1894.

Asclepias lanceolata Ives, Am. Journ. Sci. 1: 252. 1819. Not Walt. 1788.

Asclepias viridiflora var. *lanceolata* Torr. Fl. N. Y. 284. 1844.

Acerates viridiflora var. *lanceolata* Torr. in A. Gray, Syn. Fl. 2: Part I., 90. 1878.

Leaves lanceolate, 5–10 cm. long, often much elongated; anther-wings tapering rather more abruptly at the base. Otherwise as in the type, with the same range and occurring with it.

Illustrations: Ives, Am. Journ. Sci. 1: 252. 1819. Torr. Fl. N. Y. 2: *pl. 88.* 1843. In part. Hook. Fl. Bor. Am. 2: *pl 143.* 1844. In part.

Rocky Mountains: Frémont, 1842. *Nebraska:* A. B. Show; Banner Co., Rydberg, no. 232, 1891; Plummer Ford, Rydberg, no. 1306, 1893. *Kansas:* Fort Riley, no. 519, 1892. *Illinois:*

S. B. Mead. *Connecticut:* New Haven, Professor Ives (type). *Virginia:* Lynchburg, Britton, 1892. *Kentucky:* Collector unknown. *Georgia:* Small, 1893. *Louisiana:* Alexandria, Hale.

ACERATES VIRIDIFLORA LINEARIS A. Gray, Syn. Fl. **2**: Part I., 99. 1878.

Stems low; leaves linear, elongated, umbels often solitary Intergrades with the last. Said to occur from Minnesota and Manitoba to the Northwest Territory, south to Louisiana and New Mexico.

Missouri: B. F. Bush, no. 361, 1894. *Louisiana:* Alexandria, Hale.

4. ACERATES BIFIDA Rusby; A. Gray, Proc. Am. Acad. **20**: 296 1885.

In general appearance resembling the narrower leaved forms of *Acerates viridiflora*. Stems angled when dry, somewhat swollen at the nodes, puberulent; internodes 1.5–2.5 cm. long or more; leaves broadly lanceolate, 3.5–7 cm. long, 15 mm. wide or more, acute at each end, coriaceous, tomentulose, with a distinct marginal vein; umbels apparently many, lateral, sessile, globose, many-flowered; pedicels 1–1.5 cm. long, filiform, tomentulose; corolla-segments 5 mm. long, lanceolate, acute; anther-mass 4 mm. high; hoods erect, attached over the whole short column, shorter than the anthers, 2-parted for nearly half their height, the segment tapering but obtuse, the ventral margins infolded towards the bas- and entire except for a minute notch at the attachment; anther-wings salient above the middle, the angle entire, rounded and tapering towards the base; follicles not seen.

Collected only once by H. H. Rusby, in Arizona, probably in Yavapai County in 1883. A single specimen is preserved in Herb. Gray.

5. ACERATES AURICULATA Engelm. Bot. Mex. Bound. Surv. 160. 1859.

Asclepias auriculata Holzinger, Bot. Gaz. **17**: 125 and 160. 1892. In part.

Glabrous and glaucous from a branched? rootstock. Stems 2–8 dm. high, mostly solitary, sinuous above when old and rarely branched; leaves alternate-scattered, numerous and sometimes crowded, narrowly linear or filiform-linear, 5–14 cm. long, the scabrous margins not always revolute, becoming thick, coriaceous and often twisted with age; peduncles 5 mm.–2 cm. long, and with the 1 cm. long, slender pedicels and numerous slender involucral bracts, minutely puberulent; umbels many-flowered, lateral, 1 or 2, sometimes 16 on the same stem; column very short; calyx-segments minutely puberulent; corolla-segments greenish, tinged with dull purple on the outside, about 4 mm. long; hoods yellowish, with often a purplish keel, erect, crenately truncate or emarginate at the apex, the involute sides spreading at the base into broad, obscurely crenate auricles; anther-mass globose, anthers narrow and of equal width, entire or possibly notched and twisted at the middle, incurved over the anthers at the summit, the intermediate spaces marked by a verticle dark purple line; follicles erect on reflexed fruiting pedicels, about 8 cm. long, obliquely fusiform, acute, glabrous; seeds 6 mm. long, very thin; coma 2 cm. long.

Rocky ground and prairies, Nebraska, Kansas and Colorado to New Mexico and southern Texas. June to September.

Nebraska: Banner Co., Rydberg, no. 230. *Kansas:* Dodge City, Smyth, no. 164, and Caldwell, no. 273; "Kansas River," Frémont, 1845. *New Mexico:* Wright, no. 1687; Copper Mines, Mex. Bound. Surv., Bigelow; White Mts., Norton, 1895. *Texas:* Kerrville, Kerr Co., Heller. no. 1868 (distributed as *Acerates stenophylla*).

Illustration: Britt. & Brown, Ill. Fl. 3: *f. 2924.* 1898. Ined.

6. ACERATES ANGUSTIFOLIA (Nutt.) Decne.; DC. Prodr. **8**: 522. 1844.

Polyotus angustifolius Nutt. Trans. Am. Phil. Soc., Ser. 2, **5**: 201. 1834.

Asclepias stenophylla A. Gray, Proc. Am. Acad. **12**: 72. 1876.

Asclepias auriculata Holzinger, Bot. Gaz. **17**: 125 & 160. 1892. In part.

Stems mostly several from the same stout tuberous root-stock, erect, straight. 3–6 dm. high, clothed with a minute, mostly retrorse puberulence, becoming glabrate below; leaves alternate, scattered or some of the lower ones opposite, sessile, narrowly linear, 5–12 cm. long or more, glabrous, the revolute margins and thick midrib scabrous beneath; umbels small, 10–15-flowered, short-peduncled or subsessile, lateral, 7–13 or more on the same stem; pedicels 7–10 mm. long, minutely spreading or retrorse-pubescent; corolla-segments 5 mm. long, oblong, obtuse or acutish, greenish; hoods white, attached over the whole of the short column, erect, as high as the short anthers, laterally compressed, 3-dentate at the apex, the acute central tooth merely a prolongation of the thickened crest-like midrib and much shorter than the erect, obtuse lateral ones, at the base concave and gibbous, each inner margin spreading into an erosely truncate lobe which usually overlaps that of the next hood and terminates in an interior ring of five 2-lobed minute processes or appendages between the anthers; anther-wings salient and conspicuously auriculately notched slightly below the middle, narrowed at the base; follicles slender-fusiform, straight, erect on erect fruiting pedicels, about 8 cm. long, 6–7 mm. wide, acute, minutely pubescent; seeds about 5 mm. long, thin; coma 3 cm. long. (*Nothaccrates* A. Gray.)

Dry sandy prairies, Nebraska, Kansas and Colorado to north Texas. June to September.

Illustration: Britt. & Brown, Ill. Fl. 3: *f. 2925*. 1898. Ined.

Nebraska: Thomas Co., Rydberg, no. 1420. *Kansas:* Arkansas River, Frémont, 1845; Fort Riley, E. E. Gayle, no. 518; W. E. Rusby, 1878; Manhattan, M. A. Carleton; Manhattan, Norton, 1892. "*Arkansas:*" Nuttall, in Herb. Columbia University.

7. ACERATES RUSBYI sp. nov.

Glabrous up to the inflorescence, glaucous. Stems erect, stout, solitary? 6–8 dm. high or more, from a slender, branched rootstock; leaves linear to filiform-linear, 8–17 cm. long, 2–5 mm. wide, sessile, acute at the apex, rather distant, approximated in whorls of 3 above, scattered-alternate and sometimes in threes below; peduncles 1–3.5 cm. long; umbels many-flowered, lateral, solitary or in pairs; pedicels about 1 cm. long and with the numerous involucral bracts minutely puberulent; corolla-segments 4–5 mm. long, dull purple on the outside, greenish on the inner surface; column short but distinct; hoods erect, yellowish, with a darker or purplish? midrib or keel, shorter than the anthers, concave, truncate at the apex, auricled below the middle at the slightly infolded ventral margin; horn very slender, weak, transparent, arising from the base of the keel of the hood and but rarely reaching its apex; anther-wings salient and notched near the base. Follicles not seen.

With the general appearance of *A. auriculata*, but very easy to distinguish by the more regular disposition of the leaves, the shorter hoods and the obscure horns, which appear merely as a detached and free midvein or keel. Oak Creek, Arizona, June 23, 1883, collected by H. H. Rusby and distributed as *Acerates auriculata* Engelm.; Williams, Arizona, collected by Toumey, no. 249, June 28, 1892 (in U. S. Nat. Herb.).

The specimens here quoted, are, with one or two exceptions, preserved in the Herbarium of Columbia University. I am indebted to Prof. Underwood and to Dr. Small for much help and many valuable suggestions; to Mr. P. A. Rydberg for copious notes on *A. auriculata* and *A. stenophylla*, and to Dr. B. L. Robinson for the loan of type specimens for examination.

II.—THE SYNONYMY OF ASCLEPIAS CURTISSII AND OTHER NOTES.

ASCLEPIAS CURTISSII A. Gray, Proc. Am. Acad. 19: 85. 1883.

Asclepias aceratoides Nash, Bull. Torr. Club, 22: 154. 1895. Not M. A. Curtis, 1849.

Asclepias arenicola Nash, Bull. Torr. Club, 23: 252. 1896.

In a recent number of Pittonia (3 : 224. 1897), Prof. Greene proposes a new genus based on *Asclepias arenicola* Nash, which is only a synonym of a species long previously described by Dr. Gray and but little known. The section in which this species is placed in the Synop. Fl. 2 : Part 1, 402, is somewhat misleading, and the heading, 2. "Leaves alternate," has apparently been understood as including also *A. Curtissii*, which it should not on careful study of the key in the main work.

Prof. Greene claims that the plant in question out of flower could be taken for nothing but an *Acerates*. That is undoubtedly so, but that could also be said of several other species of *Asclepias* and certainly out of flower, unless very familiar to the collector, most, if not all, the species of *Acerates* could readily be put in *Asclepias*. The bi-auriculate, hastate, clawed base of the hood, which Prof. Greene notes as one of the characters of his new genus *Oxypteryx*, occurs also in our two common and well-known field species, *Asclepias tuberosa* and *A. decumbens*, species which also have entire anther-wings. *Asclepias Hallii* Gray, another little known plant, also has hoods with hastate clawed bases and entire or obscurely notched anther-wings. The triangular, almost sagittate anther-wings of *Asclepias Curtissii*, are undoubtedly an interesting variation from the usual types; but it scarcely seems to me that they are sufficiently strong characters on which to establish a genus.

The specimens of *Asclepias Curtissii* which I have examined are the following from Florida: Curtiss, 1879 (type) and Hillsboro Co.

Curtiss, 1886, in Herb. Gray; Titusville, A. H. Curtiss, Distr. N. Am. Pl. no. 2279; Manattee, J. H. Simpson, 1889; Nash. no. 1092, 1894; Nash. no. 1814, 1895. In all these specimens preserved in the Herbaria of Harvard University, U. S. Nat. Mus. and Columbia University, the umbels are on peduncles varying from 1–5 cm. in length and there is no evidence of their being subsessile.

In the same issue of Pittonia, on page 233, Prof. Greene claims that the notch of the anther-wing is an invariable character of *Acerates*, when, as a matter of fact there are species with and without notched anther-wings. Those without notches are *Acerates lanuginosa*, *A. viridiflora* and its two variations, *A. bifida* and commonly *A. auriculata*, the latter however occasionally with small notches, and very peculiar and nearly unique anther-wings. They are very narrow, not salient at the middle, but of about equal width from top to bottom, the margins apparently flattened and meeting up the middle. The remaining North American species have notched anther-wings. The notch is evidently a very variable character, often so on the same plant.

Prof. Greene asserts that the inflorescence of *Acerates* is strictly lateral. On the contrary in *Acerates lanuginosa* the solitary umbel is always terminal. In *A. Floridana*, the species on which the genus was based, there are occasionally a solitary or two terminal umbels.

Studies in North American Polygonaceae.—I.

By John K. Small.

In 1892 I began a study of the family Polygonaceae with special reference to the genera *Polygonum* and *Eriogonum*. Since that time, having been asked by the editors of the proposed Systematic Botany of North America, to prepare the manuscript on the family for the text of that work, I have made a careful review of the group. The results of my studies in *Polygonum** and *Polygonella*† have already been published and I intend, in the present paper and those of this series to follow, to publish some notes of general interest pertaining to the different genera of this fascinating family.

My studies have been furthered by the loan of a specimens and types from the Herbaria of the New York College of Pharmacy Harvard University, California Academy of Science, Missouri Botanical Garden and the National Herbarium. Professor Thomas C. Porter has contributed much valuable material of several genera, while Professor Edward L. Greene has generously placed the specimens of several of the species proposed as new in my hands, with the request that I describe them.

I.—NEW SPECIES OF ERIOGONUM.

Eriogonum depauperatum.

Perennial, slender, pale green. Stem woody, branched; branches tufted: leaves crowded; blades thinnish, linear-spatulate, 2–6 cm. long, obtuse or acutish, revolute, glabrous above, tomentose beneath; petioles slender, nearly ½ as long as the blades: scapes erect, 5–10 cm. tall, simple, sparingly pubescent or glabrate: bracts scale like, lanceolate: involucres 5–8 in a terminal head, tubular or tubular-turbinate, 3.5–4 mm. high, thinly tomentose; segments ovate, acutish, about ½ as long as the somewhat angled tube: calices pink, 2 mm. long, glabrous; segments unequal, the 3 outer broadly cuneate, undulate toothed at the truncate apex, the 3 inner cuneate, much narrower than the outer: filaments glabrous: achenes 3-angled.

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* Mem. Dept. Bot. Col. Coll. 1: 1–180.

† Bull. Torr. Club, 23: 406–408.

In dry soil on the Black Hills, South Dakota. Summer.

A species with the general habit of *Eriogonum pauciflorum*, but more delicate in all its parts. The leaves are more numerous than they are in its relative and the blades of a thinner texture, but the chief diagnostic character lies in the involucres; these organs are tubular or tubular-turbinate and twice as high as broad as compared with the campanulate involucres of *E. pauciflorum*, which are about as broad as high.

The original specimens were collected by Mr. Rydberg at Hermosa, in the Black Hills, South Dakota, June 23, 1892. Number 970. Altitude about 1,100 meters.

ERIOGONUM TENUE.

Perennial from a shubby base, slender, thinly tomentose to the flowers. Stems loosely branching, 5–10 cm. long: leaves crowded at the ends of the branches, linear or nearly so, 1–2 cm. long, obtuse or acutish, revolute, thinly tomentose, but less densely so above than beneath: scapes erect, simple, 5–10 cm. tall, furnished with a whorl of leaf-like bracts above the middle: involucres solitary tubes; turbinate; segments linear to linear-oblanceolate, obtuse, shorter than the tubes, spreading or reflexed: calices glabrous, pale yellow, 5–6 mm. long, narrowed into stipe-like bases; segments unequal, the 3 outer oblong-obovate, notched at the apex, the 3 inner spatulate, erose at the apex: filaments villous at the base: achenes 3-angled, villous above the middle.

In dry sterile rocky situations on the Columbia River, Washington. Spring and summer.

A species of slender habit, near *Eriogonum sphaerocephalum*, but distinguishable by the narrow, linear, strongly revolute leaves and the glabrous calices.

The original specimens were collected by Mr. Suksdorf, on the Columbia River, in West Klickitat County, Washington, May 15, 1884. Number 694.

ERIOGONUM PORTERI.

A dwarf perennial with glabrous or nearly glabrous foliage. Stems branched below; branches more or less densely tufted. sometimes gnarled: leaves firm; blades suborbicular or rhomboidal, 2–10 mm. long, obtuse or rounded at the apex; petioles as long as the blades or longer: scapes erect or ascending, 1–10 cm. long, simple: involucres glabrous; tube 2 mm. high, constricted at the middle, the recurved segments linear to oblanceolate, very unequal, longer than the tube: calices yellow, 6–8 mm. long at maturity; segments unequal, the 3 outer oblong-spatulate, often oblique at the base, the 3 inner cuneate-spatulate, slightly longer than the outer: filaments short, villous: achenes 3-angled.

On mountain slopes at high altitudes, Utah and Nevada. Summer and fall.

The specimens on which the above species is founded have erroneously been referred to *Eriogonum Tolmianum*. The stouter habit, the glabrous or almost glabrous foliage, the leathery leaves, the smaller involucres with their linear or oblanceolate segments and the less manifestly stipitate calices with their oblong-spatulate oblique outer segments, prevent it from being merged with *E. Tolmianum*. We have specimens as follows:

Nevada: Clover Mountains, September, 1868, altitude 3,000 meters. *S. Watson*, no. 1014.

Utah: Bear River Canon, August, 1869, altitude 2,900 meters. *S. Watson*, no. 1014. Uinta Mountains, September 25, 1879. *T. C. Porter.*

✓ ERIOGONUM COVILLEI.

Perennial, dwarf, caulescent. Stems branched at the base; branches forming tufted mats, forking, 2–3 cm. long, usually gnarled: leaves densely crowded at the ends of the branches, spatulate, 4–8 mm. long, obtuse or acutish, villous-tomentose or canescent, sometimes glabrate above; petioles much shorter than the blades: scapes erect or ascending, 1–4 cm. long, topped by a 2–6-rayed umbel: bracts foliaceous, oblong or linear-oblong: involucres turbinate, villous-tomentose; tube 2 mm. high, slightly enlarged at the base, constricted near the middle; segments 6–10, spreading, linear-oblong, obtuse: calices golden-yellow, glabrous, about 3 mm. long; segments cuneate or the outer cuneate-obovate, all rounded at the apex or the inner retuse: filaments villous near the base: achenes 3-angled.

At high altitudes in the Sierra Nevada, California. Summer.

Among the many distinct species heretofore grouped under *Eriogonum umbellatum*, the present one is a conspicuous example. The dwarf stature and habit debar it from *E. umbellatum*, while the peculiar villous or canescent tomentum of the foliage is unknown in that species.

The original specimens were collected on the high Sierra Nevada Mountains, California, in 1891, by Mr. F. V. Coville and Mr. F. Funston. Number 1656.

√Eriogonum croceum.

Perennial, shrubby below, tomentose. Stems spreading, 1–3 dm. long; branches often tufted: leaves clustered at the ends of the shoots; blades oval or orbicular-oval, 1–1.5 cm. long, obtuse, tomentose or glabrate above, abruptly narrowed at the base; petioles variable, some shorter than the blades, some longer: scapes erect, 1–2 dm. tall, simple, usually naked, except the whorl of leaf-like bracts subtending the compound umbel and one bract near the middle of the scape: involucres terminal, thinly tomentose; tubes broadly turbinate, 2–2.5 mm. long, finely ribbed; segments longer than the tube, unequal, usually broadest above the middle, acute: calices glabrous, golden yellow 5–6 mm. long, narrowed into a long stipe-like base; segments unequal, the 3 outer oblong, the 3 inner cuneate-spatulate, all obtuse: filaments villous below the middle: achenes 3-angled, 4 mm. long, sparingly villous at the apex.

A beautiful species hitherto confounded with *Eriogonum umbellatum.* It is easily distinguished by habit, and the peculiar compound umbel is at once diagnostic. The scape often bears one leaf-like tract near the middle and commonly produces a branch several centimeters below the base of the umbel. I note the following specimens: Idaho Plants, no. 3414, *Heller;* Burnes, Grant County, Oregon, September 28, 1896, *Brown;* Redfish Lake, Idaho, no. 420, *Evermann.* Ranges from 1,100 to 2,000 meters in altitude.

Eriogonum trichotomum.

Perennial, rather slender, densely tomentose. Stems woody, branching; branches spreading, 1–2 dm. long: leaves chiefly confined to the ends of the branches, elliptic, oval or spatulate, 8–15 mm. long, obtuse, slightly revolute, somewhat less densely tomentose above than beneath; petioles much shorter than the blades: scapes erect or ascending, 1–2 dm. tall, topped by a simple 3-rayed umbel, 2 rays with a whorl of bracts at the middle, 1 naked, all much shorter than the rest of the scape: involucres terminal; tubes broadly campanulate, about 2 mm. high, ribbed; segments oblong, recurved, longer than the tube: calices yellow, glabrous, 5–6 mm. long; segments spatulate, rounded or slightly retuse at the apex, the 3 inner somewhat narrower than the 3 outer: filaments villous below the middle: achenes 3 angled, 4 mm. long, villous below the apex.

At high altitudes, Mt. Hamilton, California. Summer.

One of the rare Californian species at one time referred to

Eriogonum stellatum and later to *E. tripodum*. Professor Greene has lately said* that it cannot be associated with *E. stellatum*, and to prevent the excellent *E. tripodum* from becoming a composite species we must describe it as new. Besides the less strict habit and the broader leaves, the glabrous calices serve as a ready means of separation between this species and *E. tripodum*.

The original specimens were gathered by Professor Greene on the southern and western slopes near the summit of Mount Hamilton, California.

ERIOGONUM PULVINATUM.

Perennial, matted, densely woolly-tomentose. Stems much branched, woody below: leaves crowded, spatulate, 5–8 mm. long, obtuse, wooly; blades thick, slightly revolute, narrowed into winged petioles: scapes erect, 1–1.5 cm. long, topped by a head of several involucres: involucres turbinate-companulate, 3–4 mm. high, partially deciduous; segments 5 triangular, green, shorter than the hyaline tube: calices oblong-campanulate, 2.5–3 mm. long, villous within and without, the hairs often pointing downward; segments oblong, obtuse, erect, twice as long as the tube, the inner 3 narrower than the outer: filaments slender, exserted, villous at the base: style-branches elongated: achenes 2 mm. long, 3-angled, densely villous with tangled hairs.

In dry soil, southern Utah. Spring and summer.

A dwarf species belonging to a group peculiar to the higher altitudes of the Sierra Nevada Mountains. It is related on the one hand to *Eriogonum gracilipes* and on the other to *E. nivale*. The glandless peduncle is sufficient to separate it from the former species. From *E. nivale* it differs in the looser tomentum, the clustered involucres and the villous calyx-segments.

The original specimens were collected by Mr. M. E. Jones, at Milford, Utah, June 17, 1880. Altitude about 1,500 meters.

ERIOGONUM SISKIYOUENSIS.

Perennial from a shrubby base, nearly glabrous. Stems very short or sometimes several cm. long: leaves crowded at the ends of the branches, 5–10 mm. long; blades elliptic or oval, acute or acutish, glabrous above, slightly tomentose beneath, somewhat revolute, short-petioled: scapes erect, simple 3–8 cm. tall, furnished with a whorl of bracts above the middle: involucres cam-

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* Pittonia, 3:201.

panulate; tube 3.5–4 mm. high: calices yellow, glabrous, 5 mm. long, contracted into a stipe-like base; segments cuneate-spatulate, rounded at the apex, concave, the 3 inner narrower than the three outer: filaments villous below the middle: achenes 3-angled, glabrous.

In alpine regions, northern California. Summer.

Under the name *Eriogonum Tolmianum** Prof. Greene refers to this plant as a " neat and pretty alpine species," and this it is. However, the species does not represent Hooker's *E. Tolmianum*, and may be distinguished from it as well as from all its relatives in the *umbellata* group by the long, solitary pedicel which is subtended by a whorl of several bracts.

The type specimens were found by Prof. Greene on the Scott Mountains, Siskiyou County, California, August 22, 1876. Altitude about 2,500 meters.

✓ ERIOGONUM VINEUM.

Perennial from a stout tap root, closely white-tomentose to the flowers. Stems branching; branches tufted, clothed with the persistent leaves or leaf-bases: leaves crowded; blades suborbicular or broadly oval, 5–8 mm. long, obtuse or rounded at the apex, abruptly narrowed or truncate at the base; petioles as long as the blades or shorter: scapes erect, 2–8 cm. long, simple: bracts lanceolate to ovate, united at the base: involucres 4–6 in terminal heads, vase-shaped, 4.5–5.5 mm. high, angled, constricted near the top; segments ovate, $\frac{1}{3}$–$\frac{1}{4}$ as long as the tube, the tips recurved: calices vinous-red or cream-colored tinged with vinous-red, finally 5–6 mm. long, glabrous; segments very unequal, the 3 outer oval, cordate at the base, the 3 inner spatulate, more or less crisped: filaments villous at the base: achenes glabrous, 3-angled, 4 mm. long; base acute; angles margined at the apex.

In the mountains, Oregon and California. Spring and summer. 1550–2500 meters.

Eriogonum ovalifolium together with several species has been unfortunate at the hands of most of the later authors in being made a group instead of a natural species. The present species is a conspicuous plant on account of the velvety white-tomentose foliage and the large heads of vinous-red flowers. Besides the peculiar color distinctions, the vase-shaped involucres and the large calices readily separate the species from *E. ovalifolium*.

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*Fl. Francis, 143–144.

I have the following specimens before me: California, near Rose mine, San Bernardino Mountains, altitude 2100 meters, June 17, 1894, no. 3170, *S. B. Parish*; Oregon, Powder River Mountains, altitude 2,500 meters, August 7, 1896, *W. C. Cusick.*

ERIOGONUM ROSULATUM.

Perennial, dwarf, canescent-tomentose. Stems much branched; branches densely tufted, forming matted cushions: leaves in densely crowded rosettes; blades ovate or suborbicular, 2–5 mm. long, obtuse, thick, closely tomentose, abruptly narrowed or truncate at the base; petioles shorter than the blades, dilated at the base: involucres sessile, or at maturity on scapes 1–1.5 cm. long, broadly turbinate, 3 mm. high, villous tomentose; segments about as long as the tube, unequal, lanceolate to ovate, obtuse: calices pink to vinous, 2.5–3 mm. long, glabrous, contracted into a short stipe-like base; segments firm, the inner and outer nearly equal, cuneate, retuse at the apex, especially the inner 3: filaments short, glabrous: achenes 3-angled, 2.5 mm. long, glabrous.

At high altitudes, near Mineral King, Sierra Nevada, California. Summer.

One of the few species in which the peduncle is wanting, or almost wanting, at least during the flowering period. The species is related to *E. marifolium*, the leaves resembling those of that form. The plants form compact cushions several centimeters in diameter, on account of the many short branches and the very densely imbricated leaves. The retuse calyx-segments, the glabrous filaments and glabrous achenes all serve to distinguish the two species.

The type specimens were gathered near Mineral King, in the Sierra Nevada Mountains, on the Death Valley Expedition, by Mr. F. V. Coville and Mr. F. Funston. Number 1549.

ERIOGONUM POLYPODUM.

Perennial, from a shrubby base. Foilage densely canescent-tomentose: stems much branched; branches spreading radially: leaves thick, crowded; blades loosely ovate to suborbicular, obtuse, revolute, sometimes glabrate above, abruptly narrowed or cordate at the base; petioles stout, shorter than the blades: scapes numerous, erect, 5–15 cm. tall, simple below, topped by a 3–6-rayed umbel, or a head: involucres sessile or their peduncles 1–5 mm. long, turbinate, 3–4 mm. high; segments 5–7, usually 6, oblong, obtuse, spreading: calices glabrous, about 3 mm. long; segments pink with a reddish rib, unequal, the 3 outer broadly oblong, the 3 inner cuneate-spatulate: filaments glabrous: achenes 3-angled, glabrous.

In dry soil, southern California. Spring and summer.

A dwarf species related to *Eriogonum marifolium*, the foilage of the two species being quite similar. The plants of *E. polypodum* that have come to my notice produce numerous scapes, each of which is topped by a head or a conjested umbel instead of the open more or less straggly umbel characteristic of *E. marifolium*. The broadly-oblong outer calyx-segments and the cuneate-spatulate inner segments together with the glabrous filaments all serve to distinguish the species here described as new from *E. marifolium*.

The original specimens were collected at Long Meadow, Tulare County, California, June 7–14, 1888, by Dr. Edward Palmer at an altitude of 2,200–2,800 meters. Number 204.

ERIOGONUM HARFORDII.

Perennial by horizontal rootstocks. Foliage floccose-tomentose: leaves basal; blades spatulate, 2–6 cm. long, obtuse, crispen, densely white-tomentose beneath, floccose or glabrate above; petioles longer than the blades: scapes erect, 8–10 dm. tall, simple below, forking above, stout: bracts somewhat foliaceous below, scale-like above, involucres sessile, solitary or several at the ends of the ultimate branchlets, turbinate-campanulate, 5 mm. long, fluted; segments triangular-ovate, obtuse: calices white or pink, 3.5–4 mm. long, villous at the base; segments unequal, the 3 outer orbicular-oval, the 3 inner cuneate, longer than the outer, all erose or crisped: filaments villous near the base: achenes sharply 3-angled.

On dry hillsides in valleys, Mendocina County, California. Summer.

Near *Eriogonum affine* but more robust and of stricter habit. The leaf-blades are broadest above the middle, the involucres twice the size of those of *E. affine* and the calices pubescent at the base as contrasted with the glabrous calices of its northern relative.

Named for Mr. W. G. W. Harford, who collected the specimens in company with Dr. A. Kellogg, in Long Valley, Mendocina County, California. Number 874.

ERIOGONUM MINIMUM.

A dwarf perennial with minutely canescent foliage. Stems branched; branches densely tufted, about 1 cm. long, clothed by the persistent leaves: leaves densely imbricated and crowded, the persistent ones of previous years, black, the fresh ones gray, spatulate or almost terete by the strongly revolute margins, obtuse, dilated at the base: peduncles erect, 5–10 mm. tall, simple; involucres solitary, turbinate-campanulate, 2.5 mm. high, fluted: segments triangular-ovate somewhat converging calices, villous at the base, 2.5–3 mm. long; segments unequal, the 3 outer segments oval, the 3 inner obovate, all obtuse: filaments villous at the base: achenes 3-angled.

At high altitudes in the Cascade Mountains, Washington. Summer.

This excellent little species has posed as *Eriogonum acaule*, but a casual observation is sufficient to demonstrate the impossibility of such a disposition. Besides its more slender habit, the white woolly pubescence in the case of *E. acaule* and the gray canescent pubescence in the case of *E. minimum* serve as a ready means of separation; further, the smaller fluted peduncled involucres and the calices villous only at the base cannot be specifically associated with the corresponding organs of *Eriogonum acaule*. The original specimens were collected on the Cascade Mountains, Washington, in 1882, by Mr. T. S. Brandegee. Number 372.

ERIOGONUM CLAVELLATUM.

Perennial from a thick, woody base, pale green. Stem gnarled, branched; branches clustered, thinly tomentose; leaves fleshy, strongly revolute, cylindric-clavate, 1–1.5 cm. long, obtuse, glabrous without; petioles slender, 1–2 mm. long, tomentose: peduncles club shaped, 1–2 cm. long, simple or rarely forked: bracts scale-like: involucres deciduous, long campanulate, 4 mm. long, rib-angled; segments acute, dark green, erect: calices glabrous, pink, (?) 3.5 mm. long, urn-shaped; segments saccate at the base, bent out at the middle, crisped, the 3 outer fiddle-shaped, apiculate, the 3 inner rather cuneate, narrower than the outer, acutish: filaments villous at the base: achenes 3-angled, glabrous.

On rocky hill, Barton Range, southeastern Utah. Summer.

A low and one of the more peculiar species, most closely related to *Eriogonum ericaefolium* and *E. bicolor* from which it can be separated by the club shaped leaves and peduncles, the structure of these organs being unique in the genus. The branches of the inflorescence and the flowers are loosely articulated and easily fall away.

The type specimens were collected on the Barton Range, San Juan county, Utah, on July 13, 1895, by Miss Alice Eastwood. Number 132. (Distributed as *E. Mearnsii.*)

√ERIOGONUM NODOSUM.

A white-tomentose shrub, .5–1.5 meters tall, with spreading, forking branches. Leaves small, 2–6 mm. long; blades elliptic or elliptic-ovate, acutish, revolute, narrowed into short petioles: bracts scale-like, acute or acuminate: involucres turbinate-campanulate, 2.5 mm. long, angled, sessile; segments broad, much shorter than the tube: calices glabrous, pink, 3 mm. long; segments rounded at the apex, the 3 outer oblong or obovate-oblong, the 3 inner cuneate: filaments villous below the middle: achenes 3-angled, scabro-pubescent above the middle.

In dry soil, Don Cabesas, California. Summer and fall.

A strongly marked and very conspicuous shrubby species related to *Eriogonum Pringlei* and its western homologue, but much more robust and sparingly branched. All parts of the inflorescence are at least one-third larger, while the calyx-segments are narrower than in *E. Pringlei*. The achene is scabro-pubescent above the middle as contrasted with the glabrous achene of its homologue

The original specimens were found at Don Cabesas, California, on November 1, 1890, by Mr. C. R. Orcutt. Number 1462.

√ ERIOGONUM PALLIDUM.

Perennial. Foliage clothed with a grayish-white tomentum: setm branching: leaves (lower ones not seen) alternate; blades linear-oblong to linear lanceolate, 1–2 cm. long, short-peteoled: scapes erect, topped by an umbel of three or more divisions, each division dichotomous or trichotomous below: bracts whorled, the lower linear, the upper scale-like: involucres sessile or some of the lower ones short-peduncles, obovoid, 2.5 mm. high, secund, somewhat crowded towards the ends of the branchlets; segments triangular to ovate, each surrounded by a scarious, half-circular ciliate margin: calices white to pink, glabrous, 2–2.5 mm. long, contracted into a very short base; segments unequal, the 3 outer oval or oval-obovate, retuse or notched at the apex, the 3 inner shorter and smaller than the outer, oblong or oval-oblong, rounded at the apex: filaments villous below the middle: achenes 3-angled.

In dry soil, northwestern Arizona and the Little Colorado River. Summer.

A peculiar pale tomentose species related to *Eriogonum effusum*.

The branching of the divisions of the scapes primarally separate the two species; that of the new species representing the scorpoid dichotomy, while that of *E. effusum* represents forked dichotomy.

The specimens on which the species is founded were collected by Walter Hough on the Fewkes Exploring Expedition in August and September, 1896, on the Moki Reservation, northeastern Arizona and the Little Colorado River. Number 30.

√ ERIOGONUM CURVATUM.

Perennial from a woody base. Stem branched, scaly, the branches tufted: leaves crowded at the ends of the branches; blades elliptic, 5–10 mm. long, acute or acutish, densely tomentose, short petioled; peduncles wire-like, 5–15 cm. long, curved, glabrous, simple below, forking above: bracts scale-like: involucres sessile, scattered towards the ends of the scapes, turbinate-campanulate, 2.5 mm. high, 5-angled; segments triangular, somewhat unequal, obtuse, erect: calices pink, glabrous, 1.5–2 mm. long; segments unequal, the 3 outer suborbicular, the 3 inner oblong, all rounded at the apex: filaments glabrous: achenes 3-angled.

At high altitudes, Long Meadow, Tulare County, California. Summer.

One of the numerous relatives of *Eriogonum Wrightii* and *E. trachygonum*, but more delicate in habit than either of those species. The lustrous wire-like scapes and glabrous filaments serve to separate it from its allies. The original specimens were collected at Long Meadow, Tulare County, California, at an altitude of 2,800 meters, July 7–14, 1888, by Dr. Edward Palmer. Number 207.

ERIOGONUM CLAVATUM.

Annual, acaulescent. Leaves basal; blades 5–13 mm. broad, much broader than long, undulate, strigose-hispid on both sides, cordate at the base or rarely truncate; petioles about twice as long as the blades, hispid: scapes erect, solitary, glaucous, forked above, the ultimate division filiform, the lower internodes more or less swollen above the middle: bracts scale-like: peduncles hair-like, ½ cm. long, spreading: involucres narrowly turbinate, very small, less than 1 mm. long; segments obtuse, as broad as long, shorter than the tube: calices densely hirsute less than 1 mm. long, the segments nearly equal, ovate-lanceolate, acutish: filaments glabrous.

Near *Eriogonum capillare* but leaf-blades much broader than long and the pubescent hispid. The smaller involucres and the hirsute calices are diagnostic.

The type was collected in the mountains or northern Lower California, August 8, 1884, by Mr. C. R. Orcutt.

ERIOGONUM GLAUCUM.

Annual, slender, acaulescent. Leaves basal; blades ovate or oval-ovate, 5–10 mm. long, obtuse, undulate-crisped, often inequilateral, softly hispid on both surfaces, obtuse or subcordate at the base; petioles 2–3 times longer than the blades, hirsute: scapes erect, solitary or several together, 1–6 cm. tall, glaucous, forked, the branches ascending or spreading: peduncles filiform, about 1 cm. long, more or less spreading: involucres glabrous, turbinate, 1 mm. long; segments oblong, obtuse, about as long as the tube: calices densely hirsute, 2 mm. long; segments lanceolate, acute, erect; filaments glabrous.

Closely related to *Eriogonum trichopes* and *E. inflatum*. Leaf-blades less rigid, less prominently nerved and more densely pubescent. Scapes more sparingly branched and involucres fewer than in either of its relatives. The lanceolate calyx-segments also serve to separate it from both relatives.

The type specimens were collected by Mr. C. R. Orcutt, in the Colorado Desert, in April, 1889.

ERIOGONUM CAPILLARE.

Annual, slender, acaulescent. Leaves basal; blades orbicular-ovate, 1–2 cm. broad, acutish or apiculate, finely undulate crisped, truncate at the base or subcordate, sparingly strigose on both sides; petioles about as long as the blades, tomentose: scapes erect, 4–5 dm. tall, simple below, forking above, the ultimate divisions filiform or hair-like, 1–4 cm. long, erect or spreading: involucres turbinate, about 1 mm. long, glabrous; segments 5 oblong or ovate-oblong, obtuse: calices glabrous, about 1 mm. long, long-exserted, urn-shaped, pink; segments oblong, slightly dilated at the apex and slightly revolute about the middle, the 3 inner somewhat narrower than the outer: filaments glabrous, short: achenes 3-angled, 1 mm. long; base swollen; beak slightly shorter than the base.

Another relative of *Eriogonum trichopes* and *E. inflatum*, but readily distinguished by the tomentose pubescence of the leaves as contrasted with the hispid pubescence of the two older species. The scapes are not symmetrically branched, but rather irregularly forking and the peduncles longer than in both relatives. The glabrous calices are also diagnostic.

The original specimens were received from Dr. Ebert, U. S. A., who collected them at San Carlos, Arizona, in September and October, 1893.

ERIOGONUM TRINERVATA.

Annual, slender, acaulescent. Leaves basal; blades suborbicular or orbicular-ovate, 1–2 cm. broad, obtuse at the apex, truncate or subcordate at the base, ciliate, pubescent with scattered hairs, conspicuously 3-nerved, these impressed above, prominent beneath; petioles hispid below, widely forking above, the ultimate divisions filiform: involucres goblet-shaped on spreading filiform peduncles 6–15 mm. long, glabrous, 1–1.5 mm. long, with an undulate border: calices deep pink, glabrous, nearly 2 mm. long; segments rounded at the apex, the 3 outer oblong, the 3 inner ovate: filaments short, glabrous: achenes 3-angled, glabrous.

In dry soil, Cimarron, Colorado. Summer.

A beautiful species related to *Eriogonum subreniforme*, but more robust in habit. In place of the densely tomentose leaf-blades of *E. subreniforme*, *E. trinervatum* has glabrous leaf-surfaces, except a few scattered hairs on the lower side. The blades are never cordate, as they are in its relative. The calices are at least twice the size, and the segments of the inner and outer series of entirely different shapes.

The type was collected by Professor Greene, at Cimarron, Colorado, August 25, 1896.

ERIOGONUM TURBINATUM.

Annual, stoutish, acaulescent. Leaves basal; blades suborbicular, variable in size, some about 1 cm. broad, others 3–4 cm. broad, all more or less apiculate at the apex, softly tomentose on both sides, deeply cordate at the base; petioles about as long as the blades and tomentose like them: scapes erect, stout, solitary or several together, 2–4 dm. tall, forking above, the branches ascending: bracts scale-like: peduncles ascending or spreading: involucres shorter than the peduncles, turbinate, 2 mm. long, glabrous; segments usually 5, broadly ovate, obtuse, scarious-margined, shorter than the tube: calices glabrous, pink, about 2 mm. long; segments unequal, the 3 outer suborbicular, cordate, filaments short, glabrous: achenes 3-angled, nearly 2 mm. long, with an obovoid base, beaked.

In habit *Eriogonum turbinatum* resembles *E. deflexum*, though more robust, while in floral characters it is allied to *E. Hookeri*. The suborbicular outer calyx-segments readily separate it from

E. deflexum, with which species it has been confused, while the manifestly peduncled narrowly-turbinate involucres debar it from *E. Hookeri*.

The type was found by Mr. Pringle on mesas near Tucson, Arizona, May 2, 1884. Dr. Palmer collected the species at St. George, Utah, in 1877. Number 430.

II.—A NEW GENUS OF POLYGONACEAE.

The mountains of southern California have yielded many interesting and peculiar plants; some of these have been carefully studied and properly disposed of, while others are still far from their true systematic positions. The plant known as *Oxytheca Parishii* is an illustration of the latter class. Leaving this species out of consideration for a moment, we will have two distinct strains in *Oxytheca;* the one extreme represented by *Oxytheca luteola* and the other by *Oxytheca perfoliata.* All known members of the group fall naturally into one or the other of the two divisions, save *O. Parishii*, and to include this in the genus necessitates a third subgenus and a great extension of the generic characters. The latter alternative was resorted to by Dr. Parry, the author of the species, but it seems to me unsystematic and confusing thus to extend simple and clear-cut genera to such an extent.

ACANTHOSCYPHUS.

Annual, slender, nearly glabrous, acaulescent herbs, with erect, wiry, forking scapes. Leaves basal, firm, denticulate with spinulose teeth, dilated at the base. Bracts scale-like, ternate, united at the bases, inclined to one side of the axes. Involucres turbinate, truncate, on wire-like peduncles, with 18–20 hard ribs which are prolonged into as many rigid acicular awns, these surpassing the tube in length. Flowers 5–14, of two kinds: staminate included: pistillate exserted. Pedicels subtended by linear or linear-spatulate bracteoles. Calyx glabrous, segments 6. Stamens 9, inserted at the base of the calyx. Embryo with a long, curved radicle and accumbent cotyledons.

A monotypic genus of southern California.

ACANTHOSCYPHUS PARISHII (Parry).

Oxytheca Parishii Parry, Proc. Davenp. Acad. Sci. 3: 176. 1882.

In dry soil, San Bernardino Mountains, California, altitude 1,400 meters, August 5, 1881. Number 993.

Some Changes in the Nomenclature of North American Rosaceae.

By P. A. Rydberg.

The writer had intended to publish the following changes in his forthcoming monograph of the North American Potentilleae; its publication having been delayed and a friend of his intending within a short time to issue a checklist of North American plants, it seems advisable not to defer the publication longer, especially as some of the changes have been in manuscript for almost a year. Most of these changes occur in the genus *Horkelia*, which the writer regards as distinct from *Potentilla*. Many of the species were originally described under the latter genus taken in its wider sense, others as varieties of other species. The reasons for the changes will be discussed more fully in the forthcoming monograph.

Horkelia frondosa (Greene).

Potentilla frondosa Greene, Pittonia, 1 : 300. 1889.

Horkelia elata (Greene).

Potentilla elata Greene, Pittonia, 1 : 100. 1887.

Potentilla Californica elata Greene, Fl. Frans. 1 : 66. 1891.

Professor Greene originally described this as a distinct species, but afterwards reduced it to a variety of *P. Californica*, a treatment quite unexpected from a botanist well known for his liberal views with regard to the limitation of species. *H. elata* differs from *H. Californica*, not only in the narrower filaments, but also in the more slender habit and the deeply dissected leaflets. I think it should be regarded as a distinct species.

Horkelia Micheneri (Greene).

Potentilla Micheneri Greene, Erythea, 1 : 5. 1893.

√ Horkelia Clevelandii (Greene).

Potentilla Clevelandii Greene, Pittonia, 1 : 102. 1887.

✓ HORKELIA PUBERULA (Greene).

Potentilla puberula Greene, Pittonia, **1**: 102. 1887.

✓ HORKELIA PLATYPETALA, n. n.

Horkelia Parryi Greene, Bull. Cal. Acad. **2**: 416, partly, as to description. 1887. Not *H. Bolanderi* var. *Parryi* Wats.

Dr. C. C. Parry distributed, in 1887, specimens of this species under the name *Horkelia Bolanderi* var. *Parryi* Wats. As Dr. Watson's description of that variety is very short and in no essential particular disagrees with the present species, Prof. Greene was misled and described it as a new species under an old name, believing that he only made a new and better description. The original specimen from which Watson's description was made is at the Gray Herbarium and has narrow petals like those of *H. Bolanderi*, while in *H. platypetala* the petals are broadly obovate.

✓ HORKELIA TENELLA (Wats.).

Horkelia fusca var. *tenella* Wats. Bot. Cal. **1**: 181. 1876.

In my opinion, this is a good species.

HORKELIA DAUCIFOLIA (Greene).

Horkelia congesta Brew. & Wats. Bot. Cal. **1**: 181. In part. 1876.

Potentilla daucifolia Greene, Pittonia, **1**: 160. 1888.

Potentilla congesta var. *lobata* Lemmon, Bull. Torr. Club, **16**: 221. 1889.

HORKELIA LAXIFLORA (Drew).

Potentilla laxiflora Drew, Bull. Torr. Bot. Club, **16**: 151. 1889.

HORKELIA HOWELLII (Greene).

Potentilla Howellii Greene, Pittonia, **1**: 104. 1887.

✓ HORKELIA PINETORUM (Coville).

Potentilla purpurascens pinetorum Coville, Proc. Biol. Soc. Wash. 7: 77. 1892.

It is nearest related to *H. purpurascens* Wats., but without doubt is a good species.

Horkelia sericea (Gray).

Horkelia Californica var. *sericea* Gray, Proc. Am. Acad. 6: 529. 1865.

Horkelia Kelloggii Greene, Bull. Cal. Acad. 2: 416. 1887.

Potentilla Kelloggii Greene, Pittonia, 1: 101. 1887.

✓ Fragaria glauca (Wats.).

Fragaria Virginiana var. ? *glauca* Wats. Bot. King Exp. 85. 1871.

This is an excellent species, easily distinguished from *F. Virginiana* by its lower habit, glaucous hue, more glabrous leaves, appressed pubescence on the petioles and the scape, and almost always sessile leaflets.

✓ Geum Oregonense (Scheutz).

Geum urbanum subsp. *Oregonense* Scheutz, Prod. Monog. Georum, in Nov. Act. Soc. Sci. 7: 26. 1870.

This has no close relationship to *G. urbanum*. Scheutz described it from a fragmentary specimen consisting of the upper portion of the plant without the basal leaves. In fact, *G. Oregonense* is much more related to *G. macrophyllum* and *G. strictum*, and in habit rather intermediate between the two. It differs, however, from both by its smaller and lighter yellow petals, its smaller heads of achenes, and the glandular puberulent lower portion of the styles. It is the most common species in Montana and westward.

Book Reviews.

Lessons With Plants. Suggestions for seeing and interpreting some of the common forms of vegetation, by Professor L. H. Bailey. New York. The Macmillan Company. $1.25.

Professor Bailey has for some time interested himself in the education of the young, especially by means of Botany, and his book "Lessons with Plants," gives to the teaching body his ripened ideas in regard to the matter. Like all of the writings from his pen, the work bears the mark of freshness and vigor of thought so characteristic of the man.

The object of the work, to quote the author's words, is "to suggest methods, not to present facts." Even a hasty glance is, however, enough to convince one that the basis of the work is the author's own study, and the suggestions of the book are an outcome of that study. Naturally, therefore, the cultivated plants are made to teach their lessons, and the commonest of these and of the plants which are found in a wild state are the materials for study.

It is worthy of remark that the idea which underlies the method of presentation is the morphological idea. It is evident that the writer attributes a considerable value to the comparative study of organisms, and we have no hesitancy in endorsing this view. To be sure, the objects studied are to be regarded as living objects, objects which are doing something, and it is this way of combining the study of structure and of function that brings out the chief interest in the subject, and that makes it one of such great value in the education of children.

Another fact of importance is this ; the author is constantly in search of causes. The way of thinking which grows out of this kind of study is that which is characteristic of the strong independent mind, and to the building up of such minds in our youth should be bent the energies of all educators.

The work is fully illustrated with pictures from the pen of Mr. W. S. Holdsworth, and all of them are new and suggestive. The teacher, who is himself a student, can do no better than to take this book as a starting point. It will start him aright, and by adopting Prof. Bailey's method, which is no more nor less than the scientific method, he will gain in intellectual strength at every step. Undoubtedly such a teacher cannot fail to bring good out of his pupils.

Nature Study in Elementary Schools, a Teachers' Manual by Mrs. L. L. Wilson, Ph.D. New York. The Macmillan Company. 95 cents.

This book of 216, 12mo pages contains suggestions for teachers of, presumably, the lower grades on various topics in nature study, including the weather, plants, animals and stones, and is planned to help the teacher without scientific training to start and carry on her work with children in nature study. As such it ought to be useful, inasmuch as the author dwells at some length from time to time upon the method of presentation. There are abundant references to prose and poetry touching upon the matter in hand. The author, being first a naturalist, a large portion of the book is given to the animals and plants, but the treatment is of necessity brief, and at times, from some standpoints at least, unsatisfactory, as for example, the part on lichens. In criticising such a work, however, it is of first important to keep in mind the author's point of view, which, in this case, is, it would seem, to indicate the spirit of the work and its mode of procedure. As a result of condensation, some statements have crept in which might mislead the class of persons for whom the work is designed, as, for instance, when pollen is spoken of as "dust which makes the seeds" or as when the tunics of the onion bulb are apparently regarded as "crowded leaves full of nourishment" when in point of fact they are but portions of leaves. Whether a loose statement such as this is warranted by the pedagogic principle advocated on page 23, "Function should precede form" or not is to be questioned and this is a real difficulty which confronts the teacher of the young. The reviewer thinks it is not, because experience tells us how difficult it is to eradicate the misconceptions gained in youth. Of the same nature is the question as to how to separate in the child's mind efficient and final causes. This problem is indicated by inference on page 171, where the question Why? is asked to bring to a fruitful result the observation that some twigs grow more rapidly than others. The answer would be that some twigs were too crowded, so that their leaves could not get the sunlight, and were, as a result, dwarfed. In other words, we have an effect following a cause. But a little later on the question is asked "Why are the buds sticky?" The answer expected is one which is teleological and deals not with efficient proximate causes, but with final ones. Here, again, one is tempted to ask if more exact thought may not be expected. Perhaps not, and yet it is a goal which should be striven for. Teachers themselves ought certainly to keep such distinctions in mind.

After all, the spirit of the author is good, and the book will be useful directly as the teacher herself is a student.

F. E. L.

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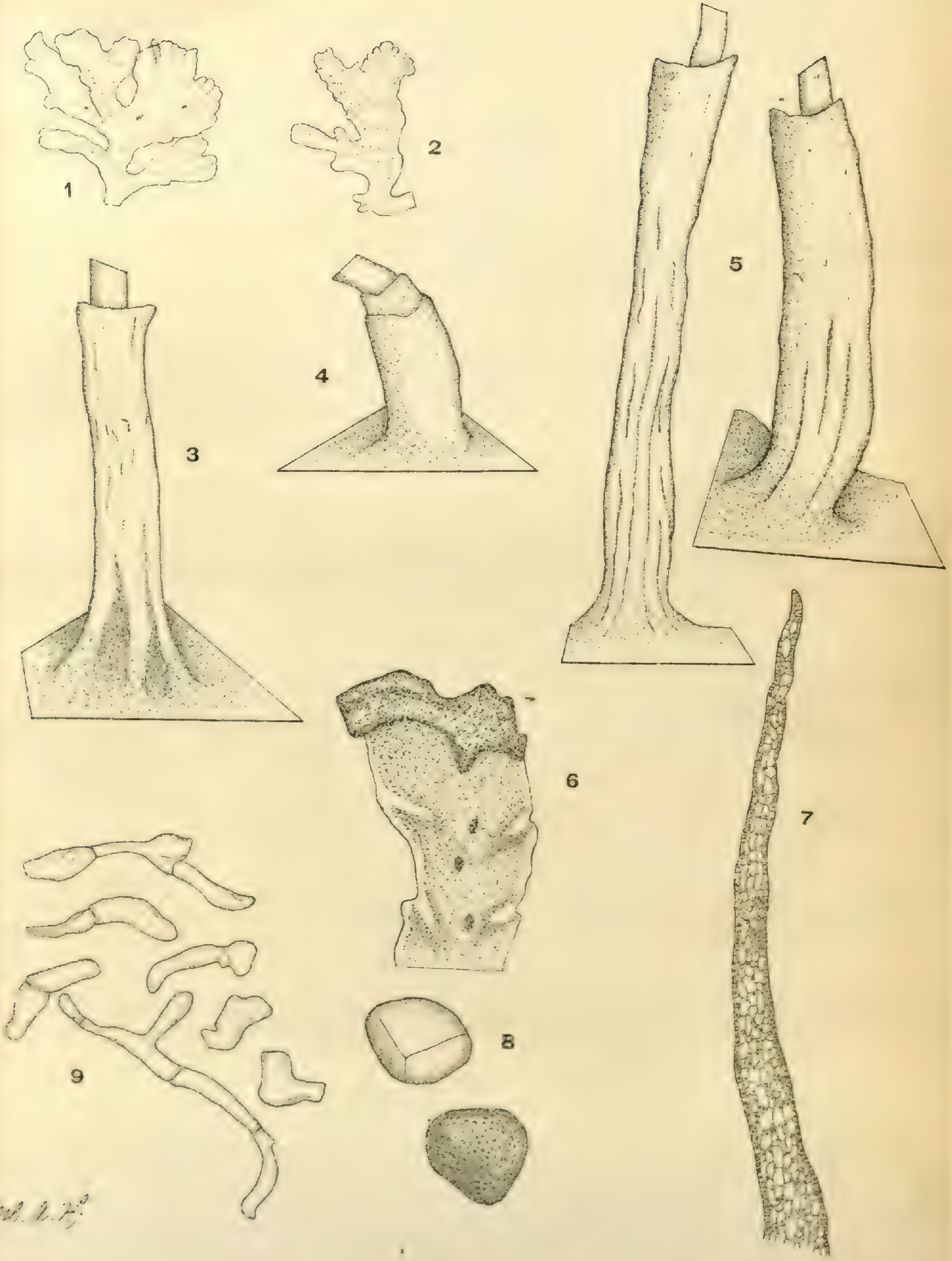
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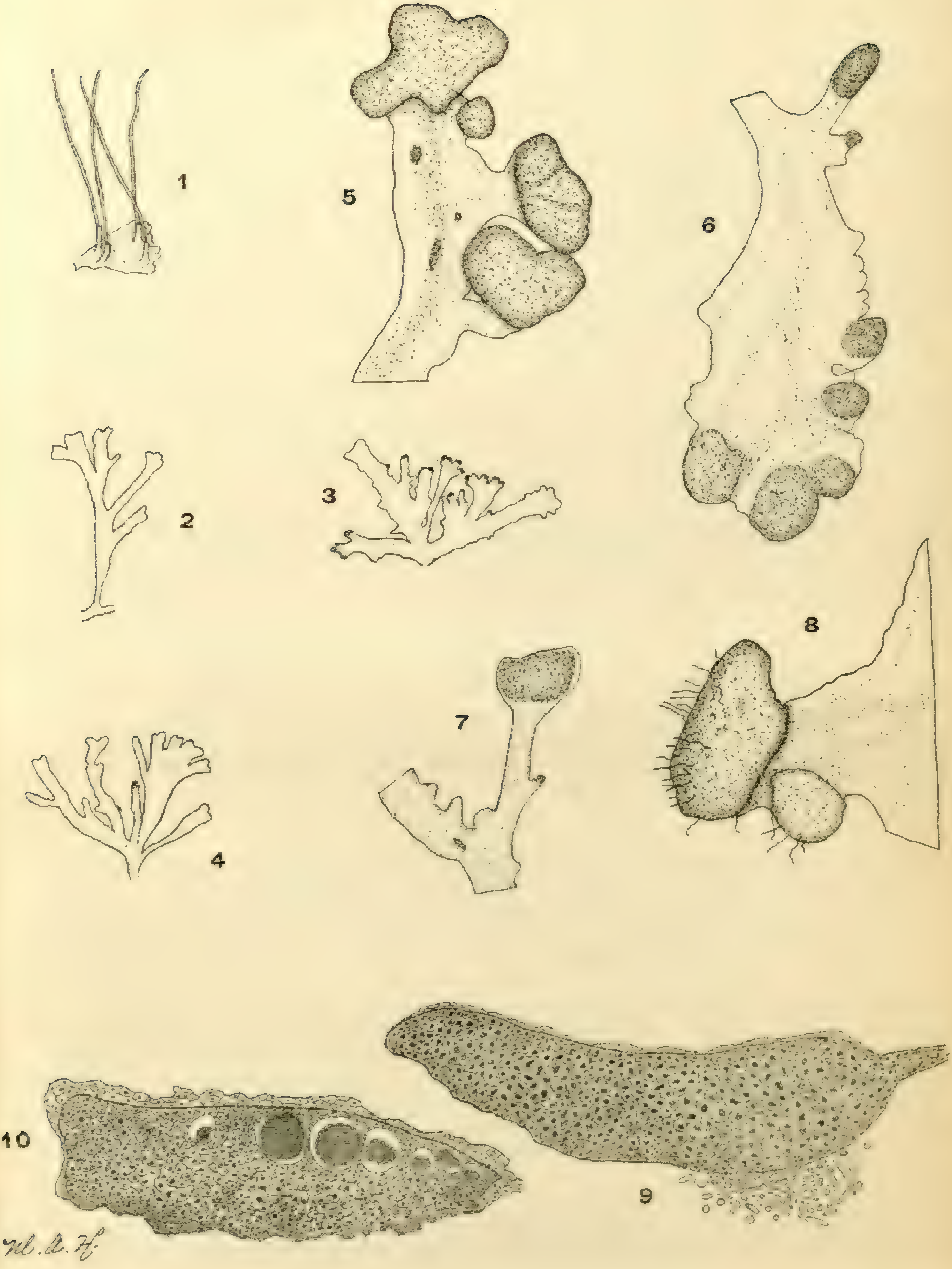
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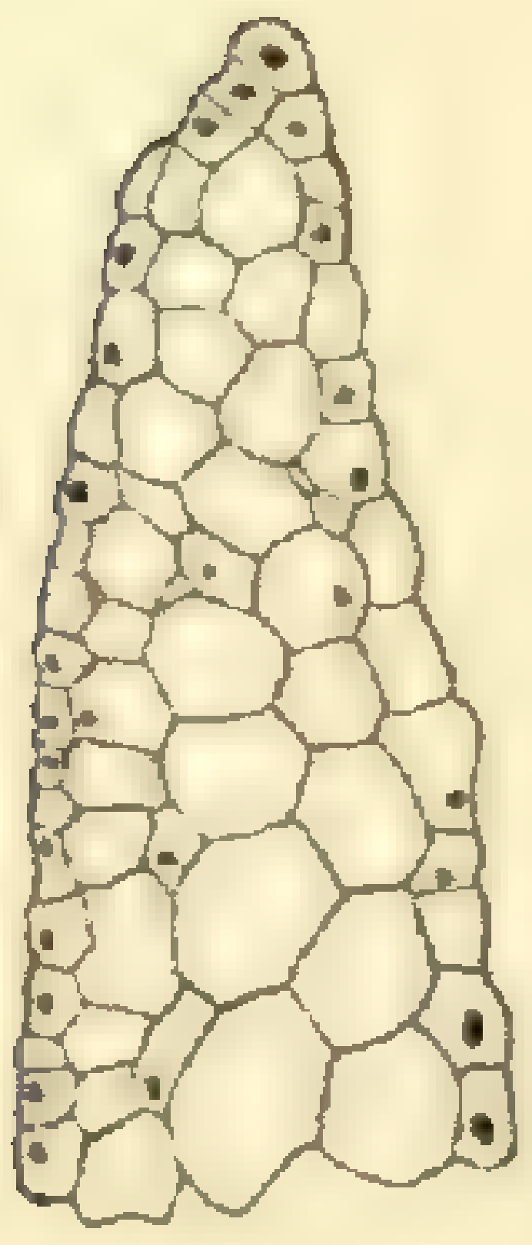

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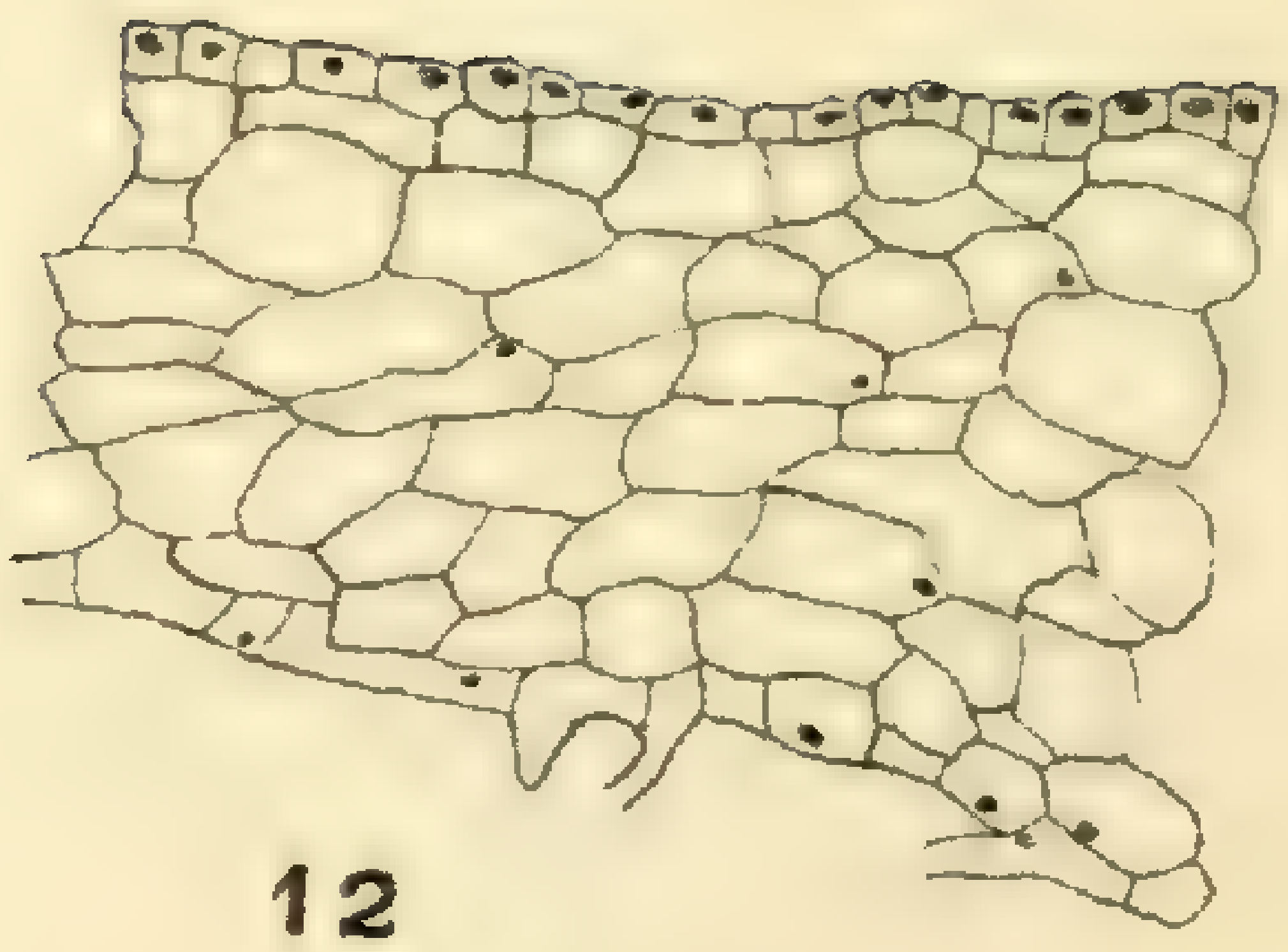

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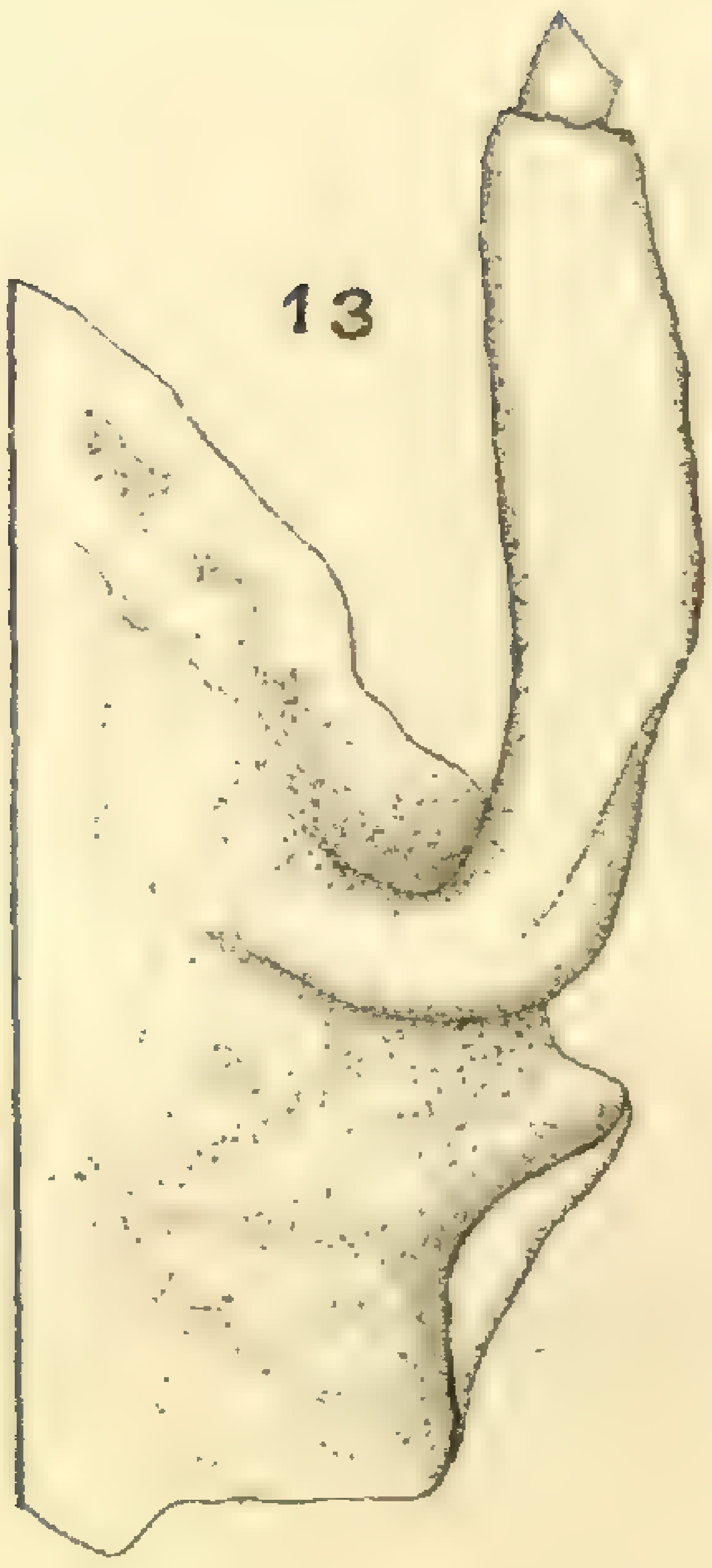

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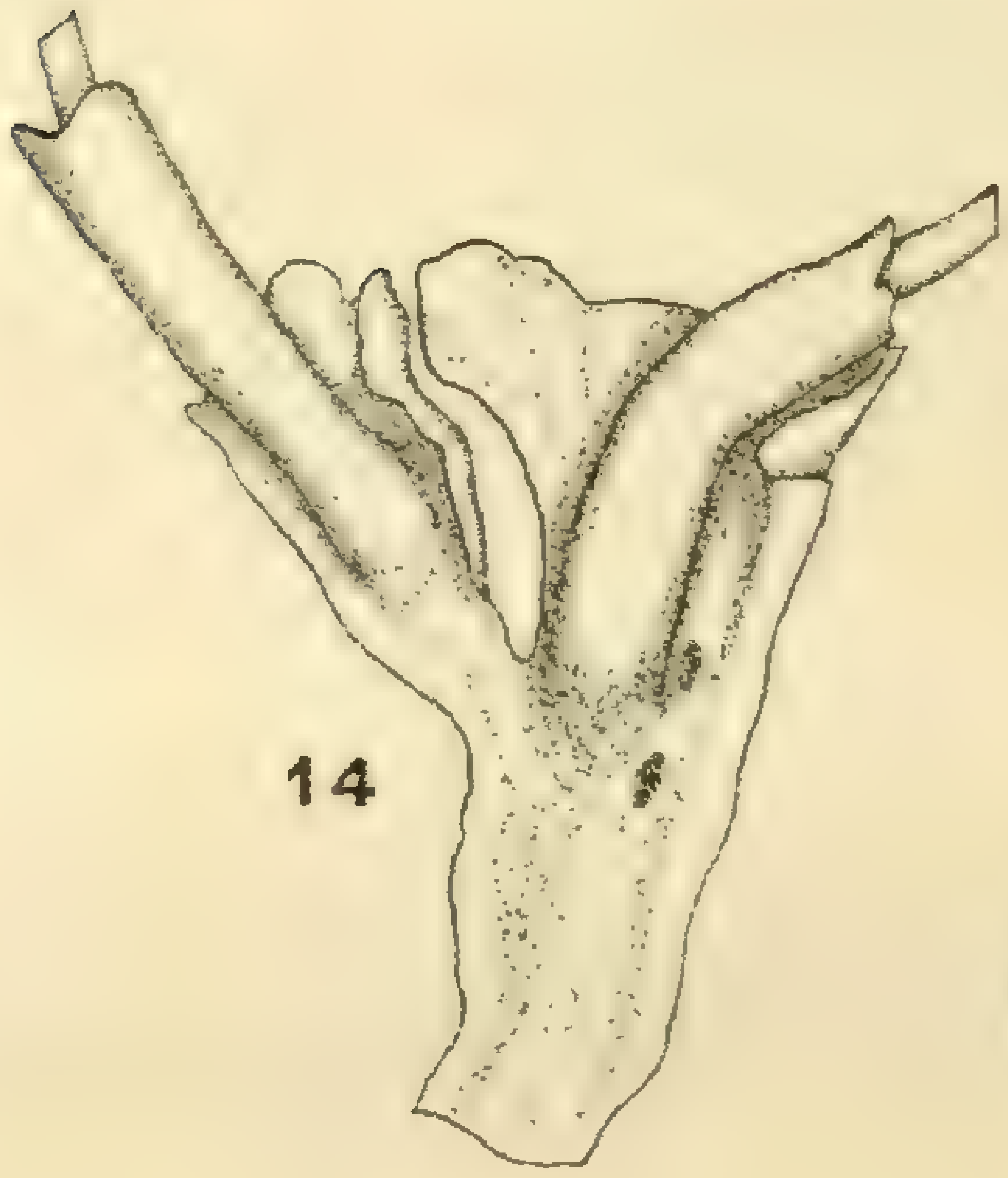

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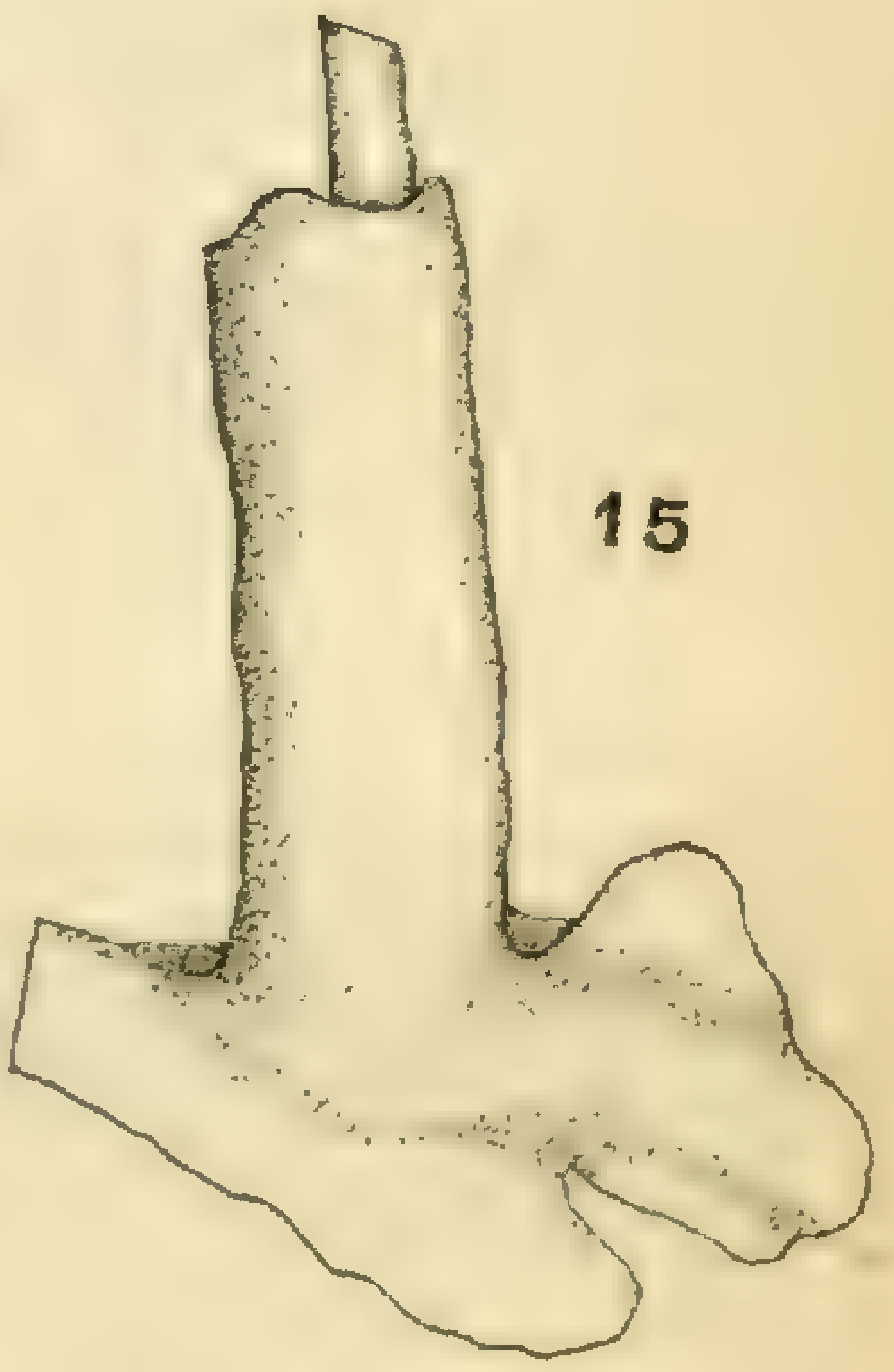

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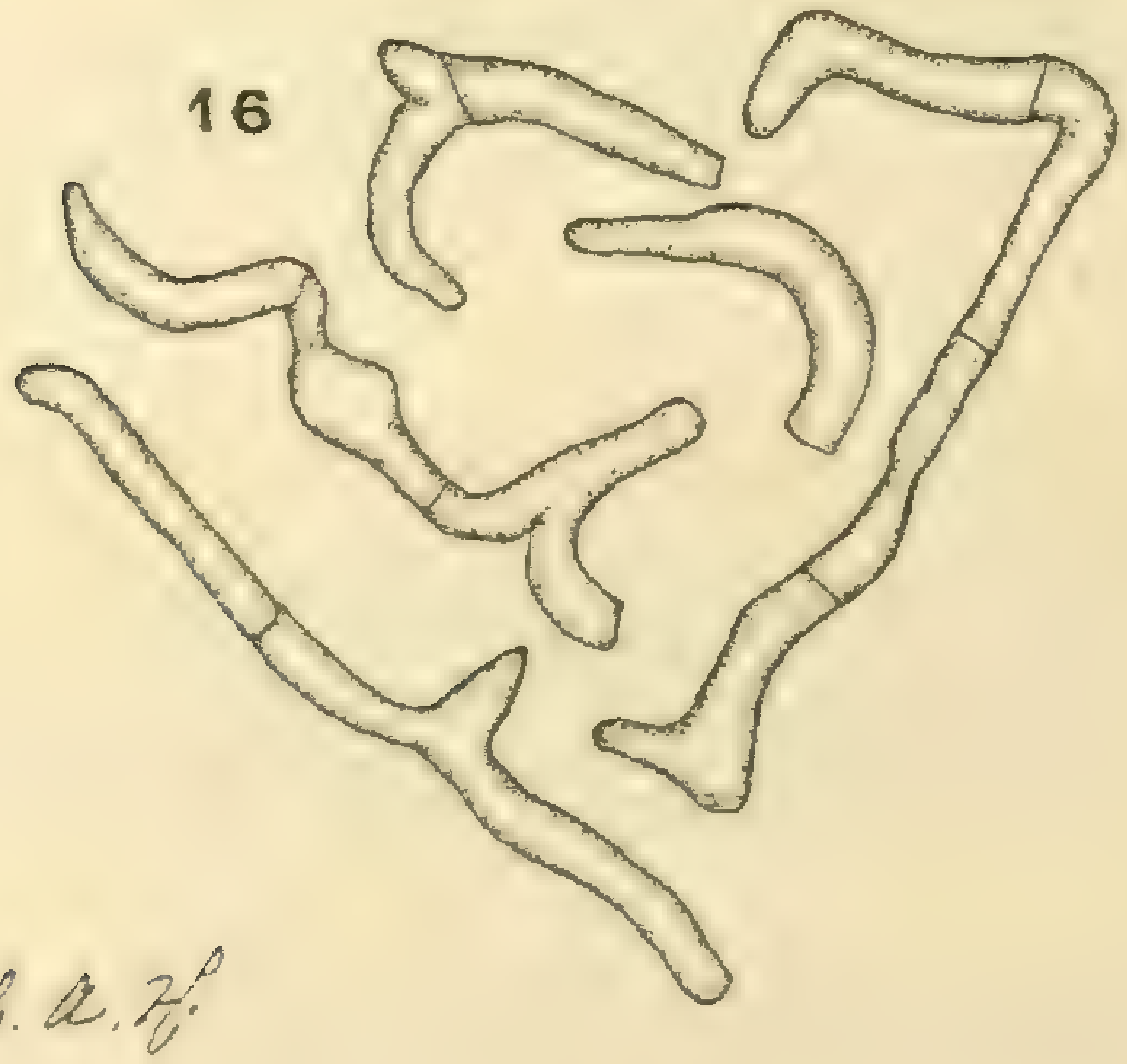

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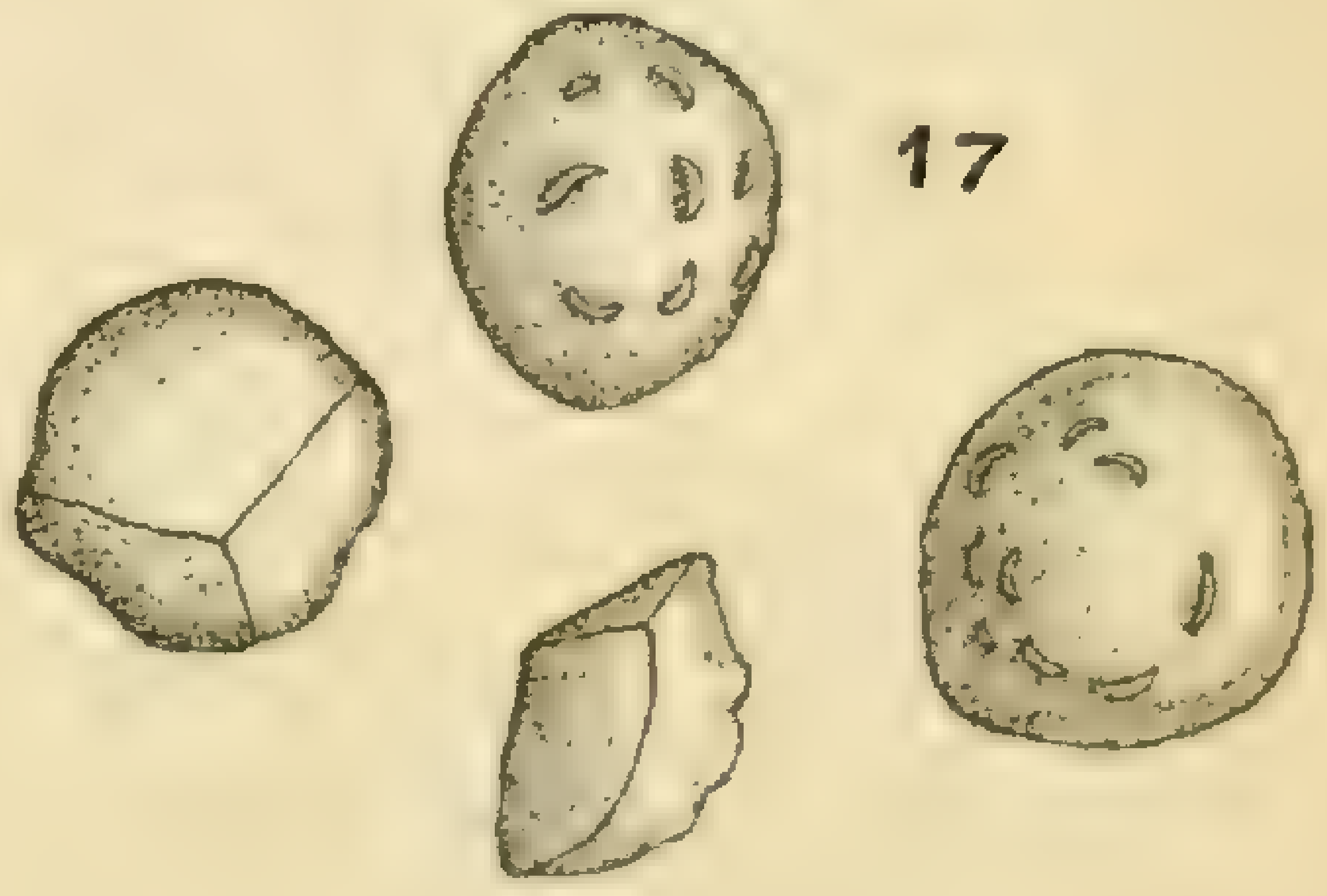

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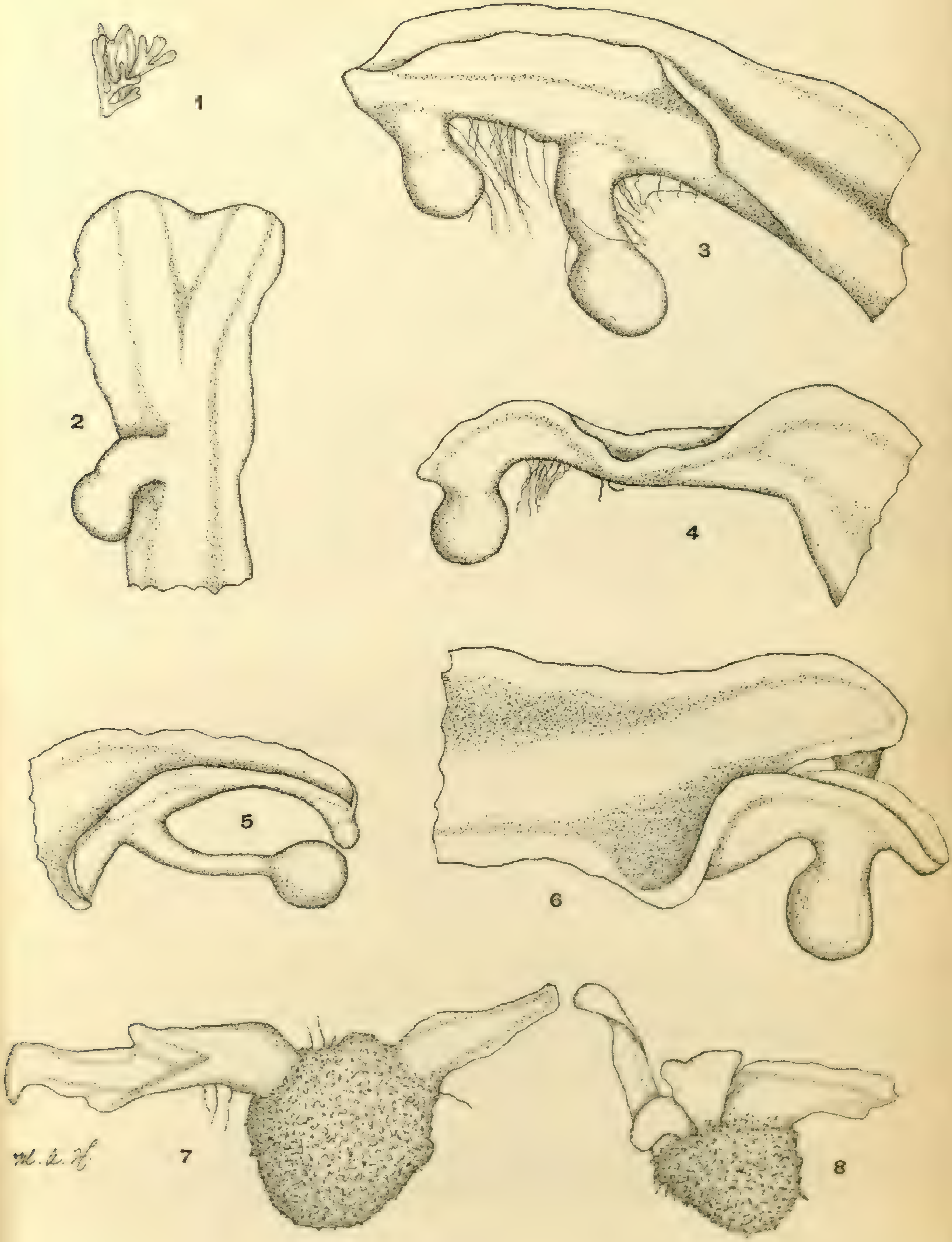
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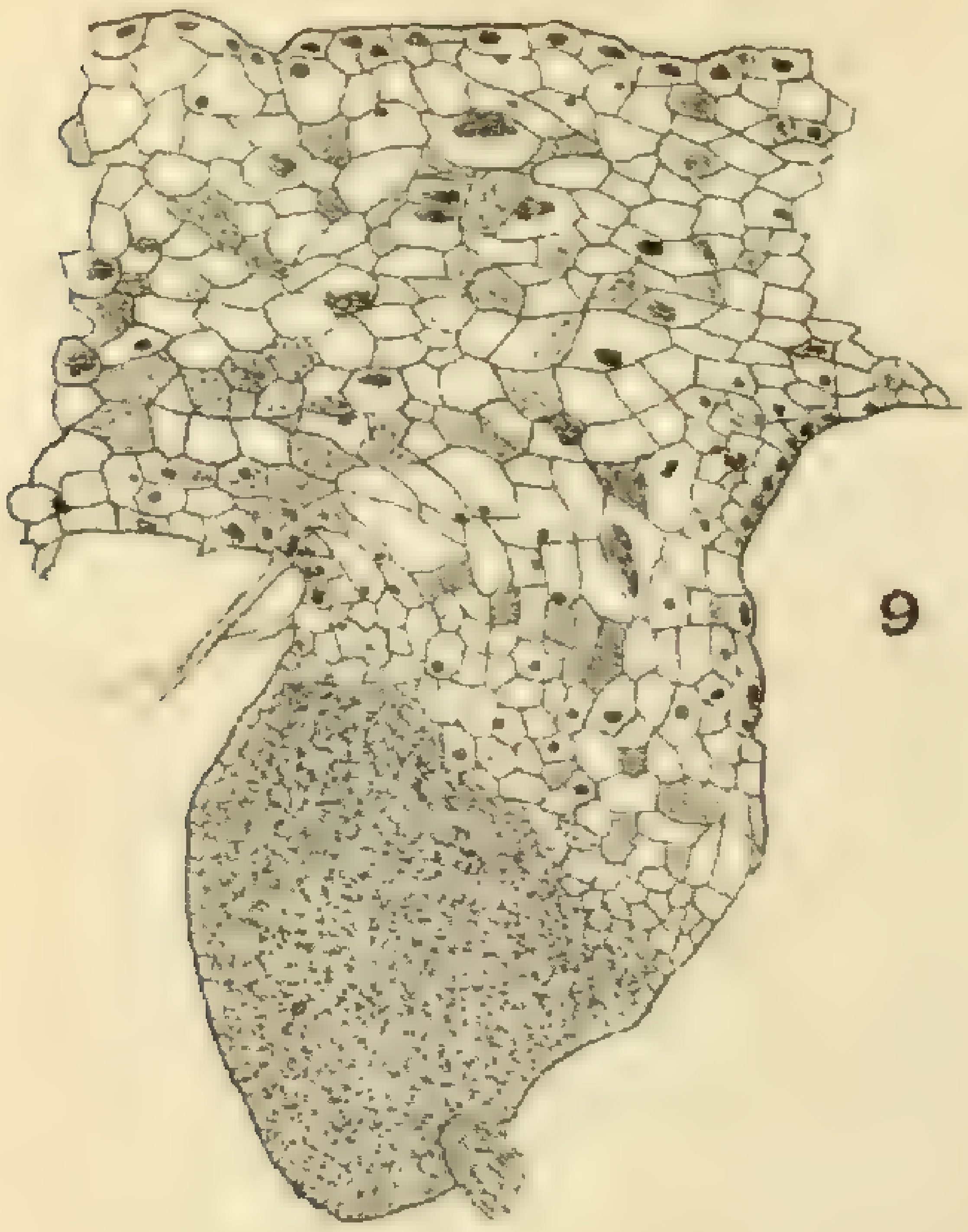
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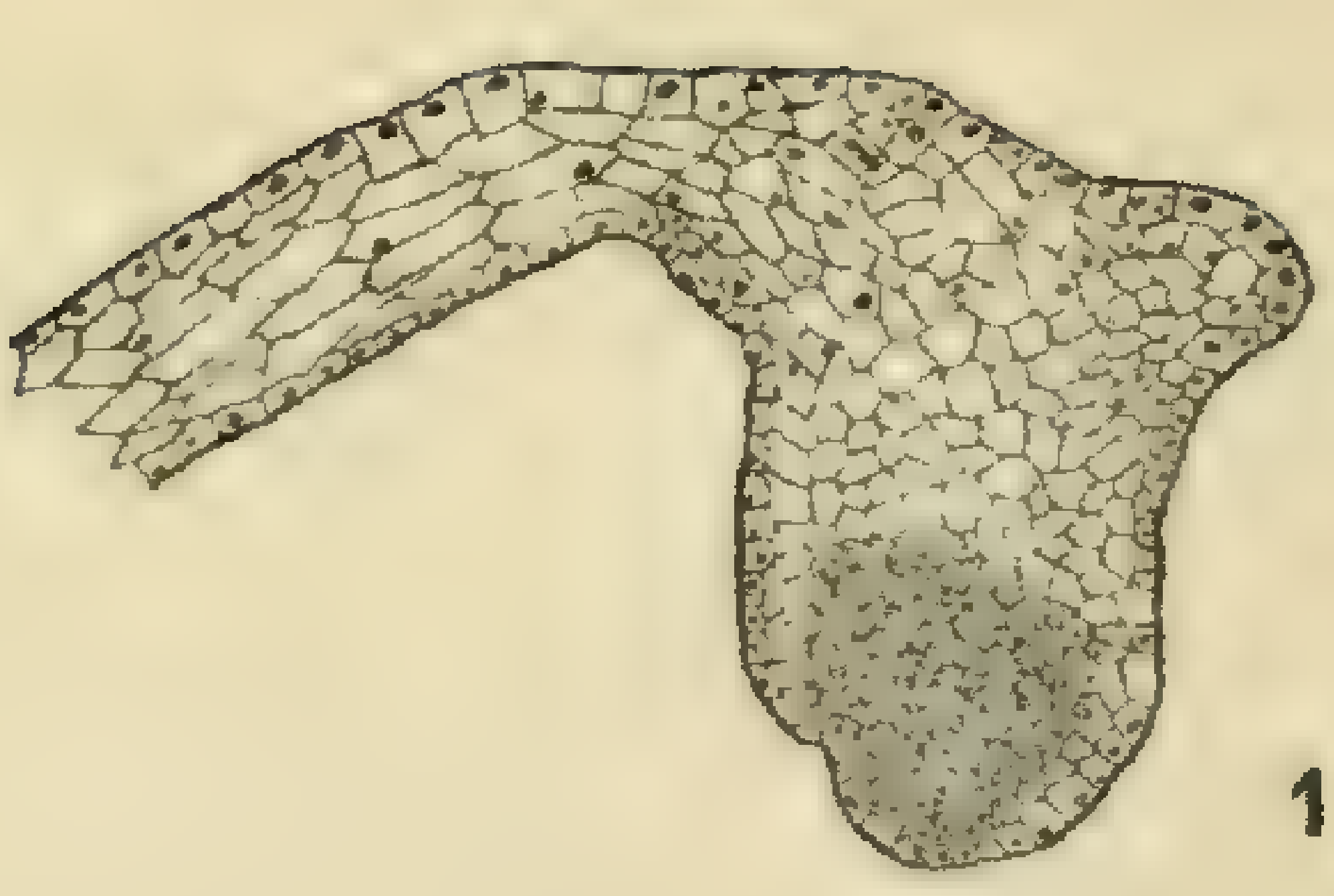
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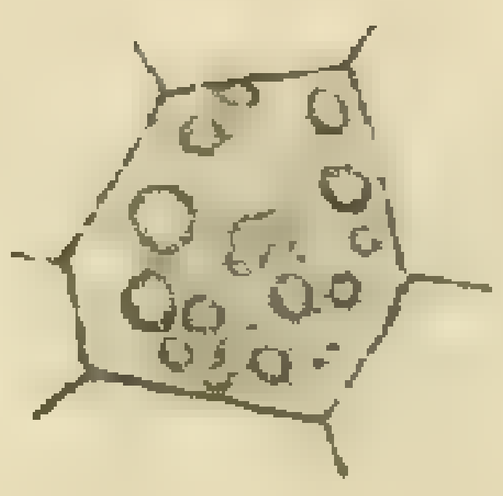
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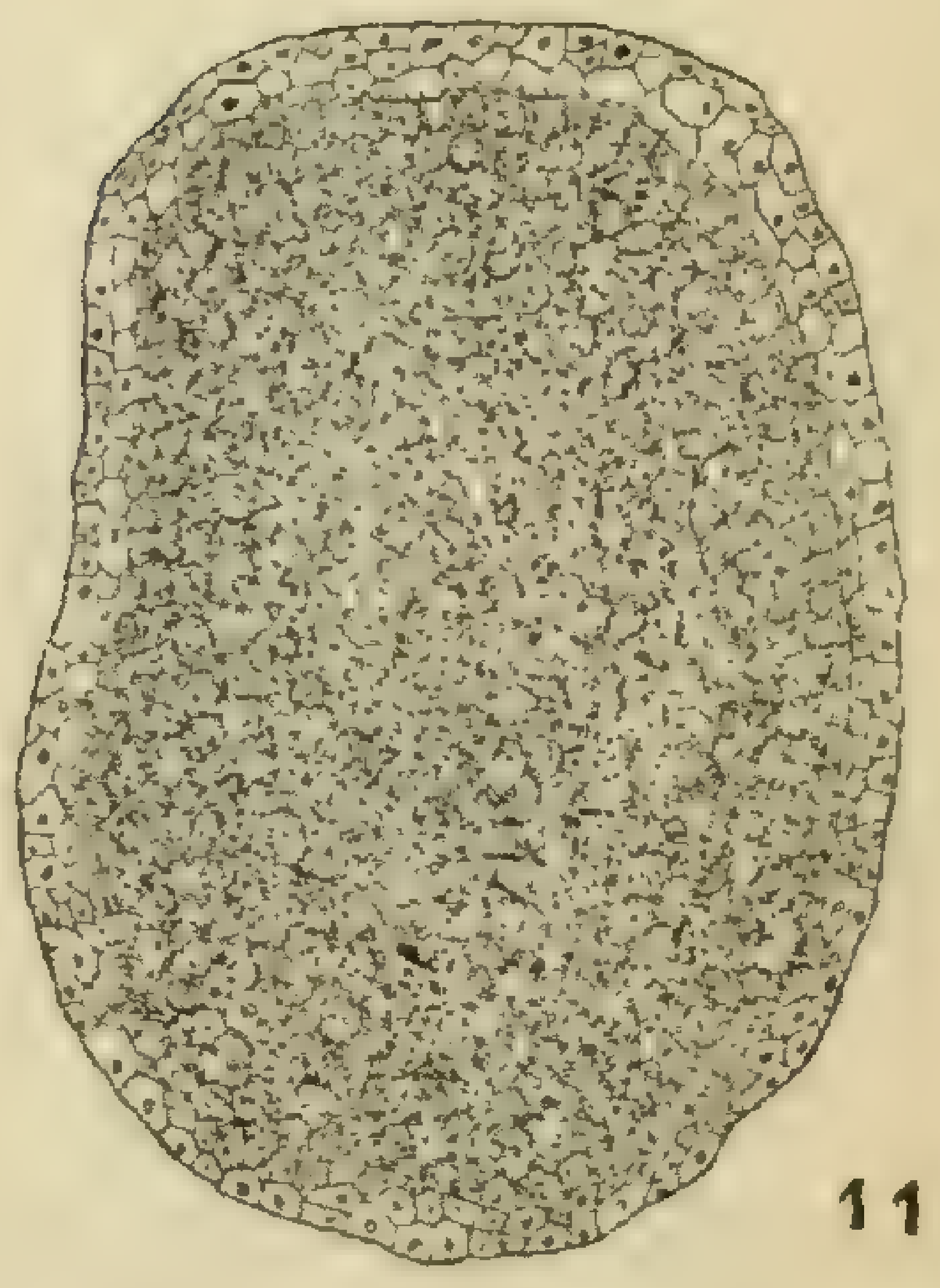
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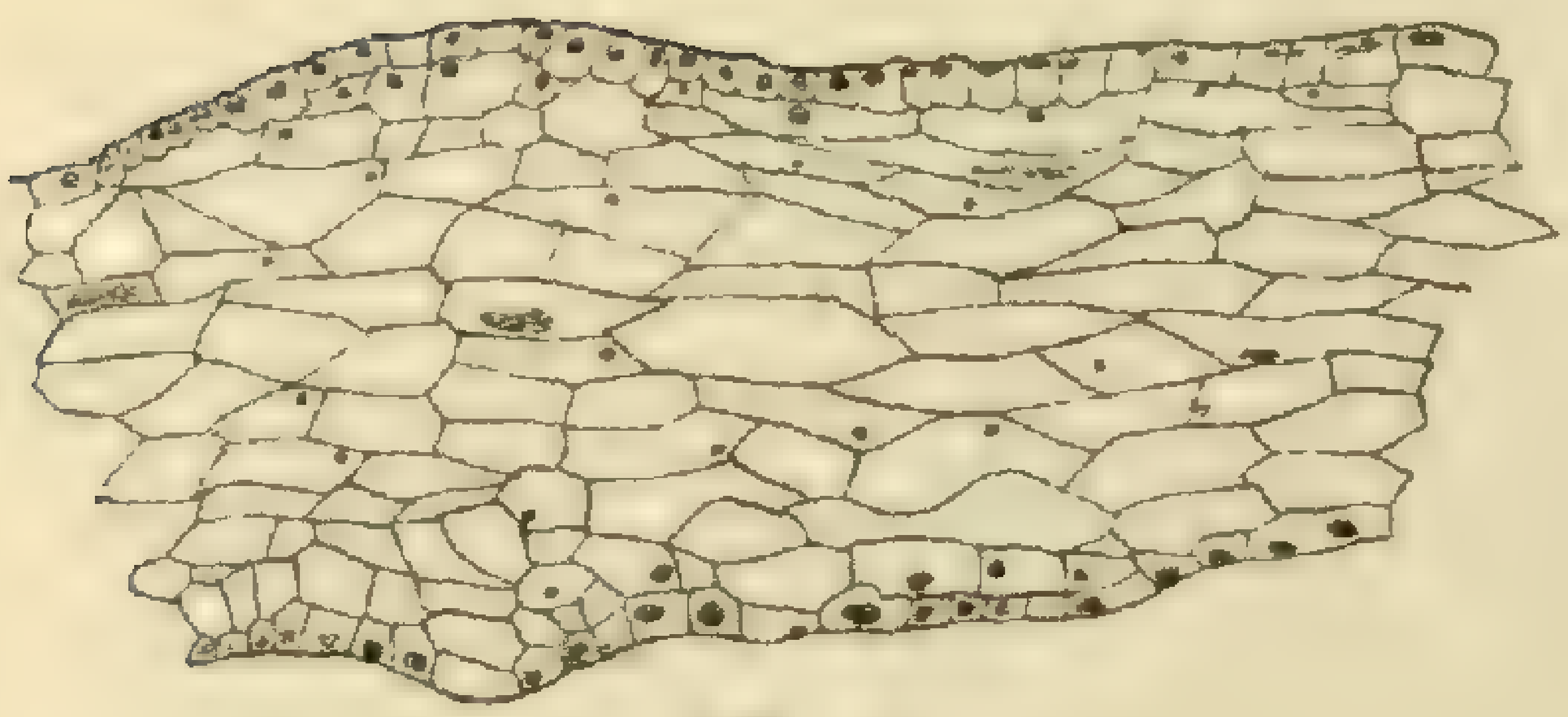
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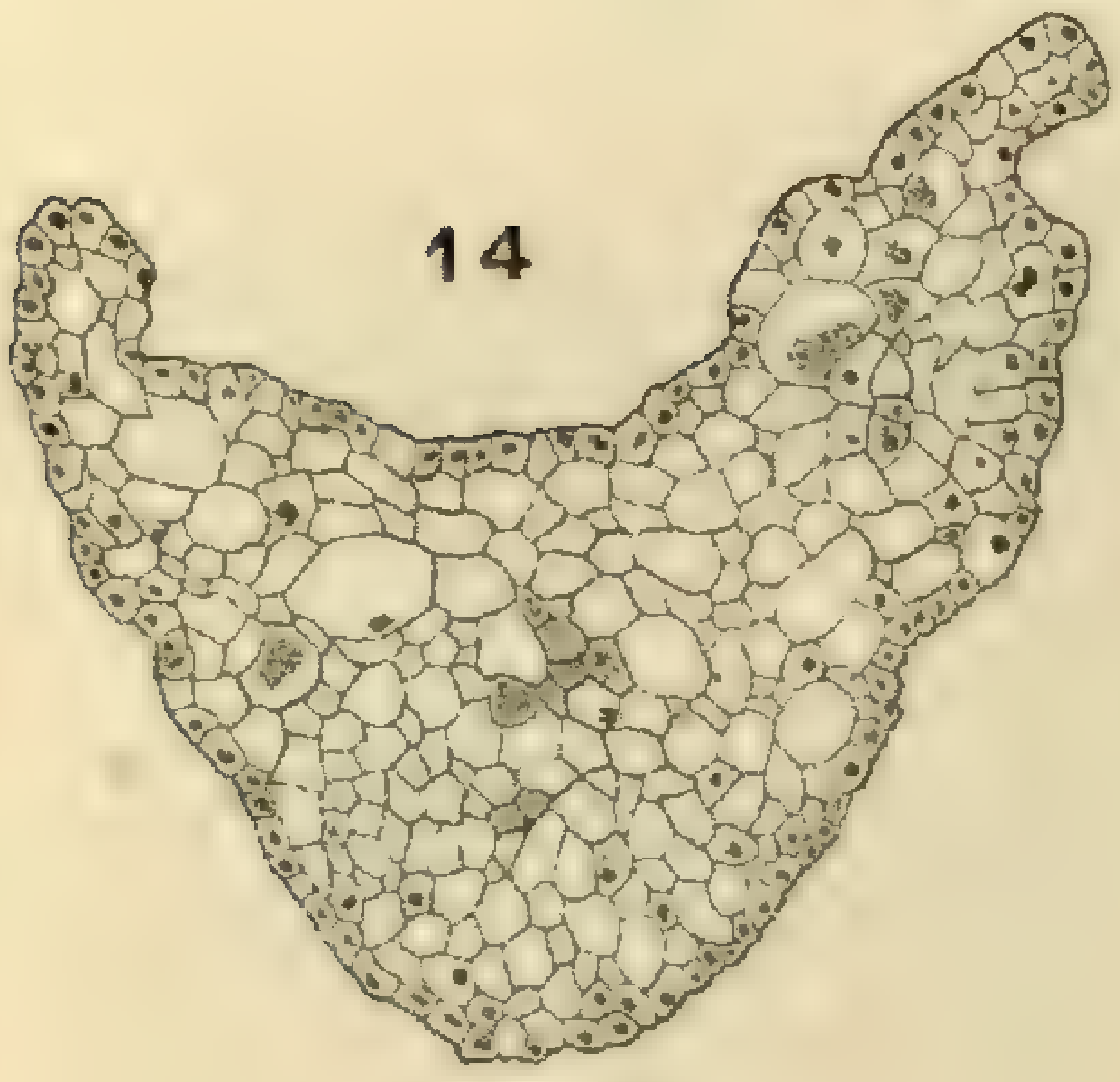
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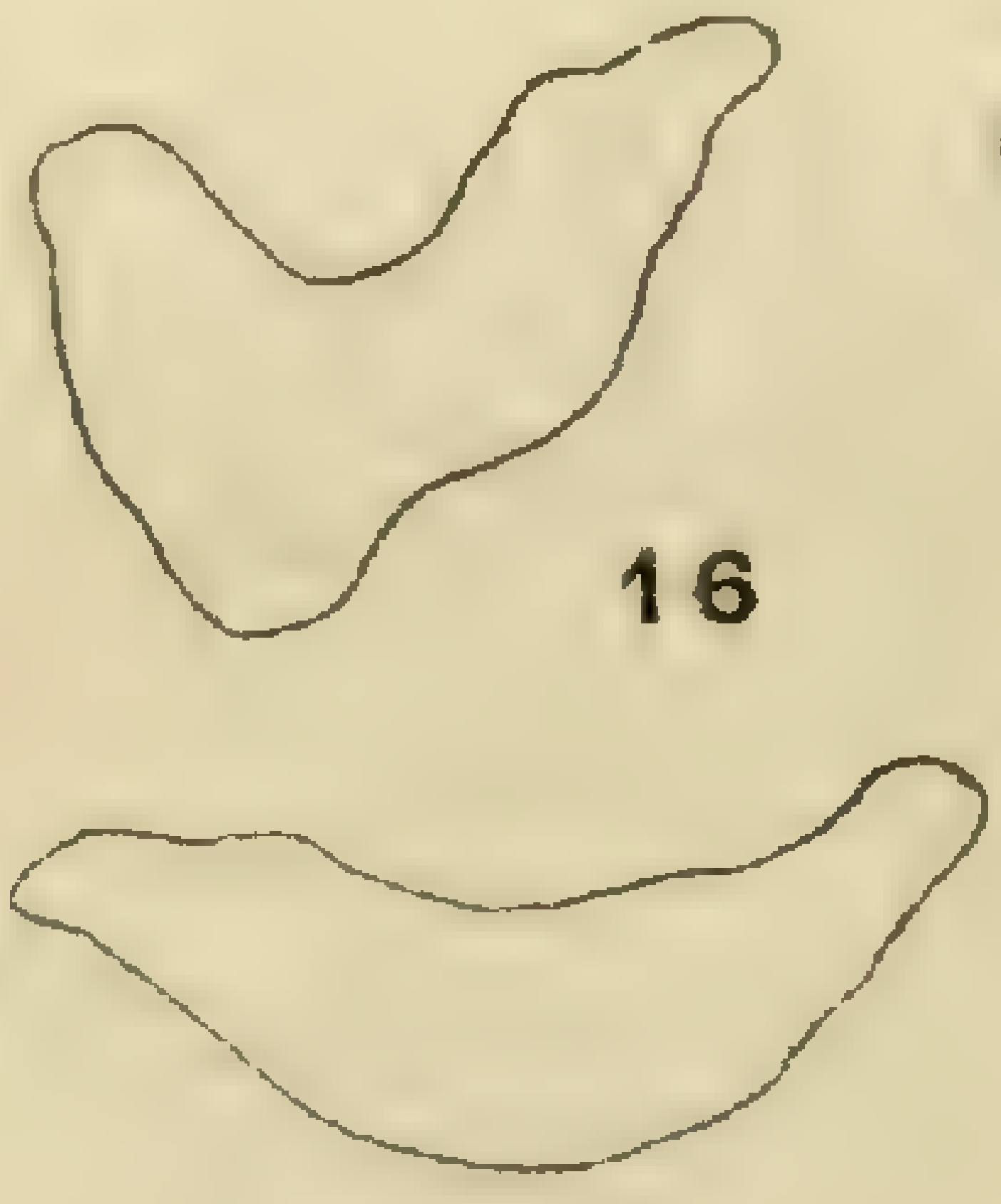
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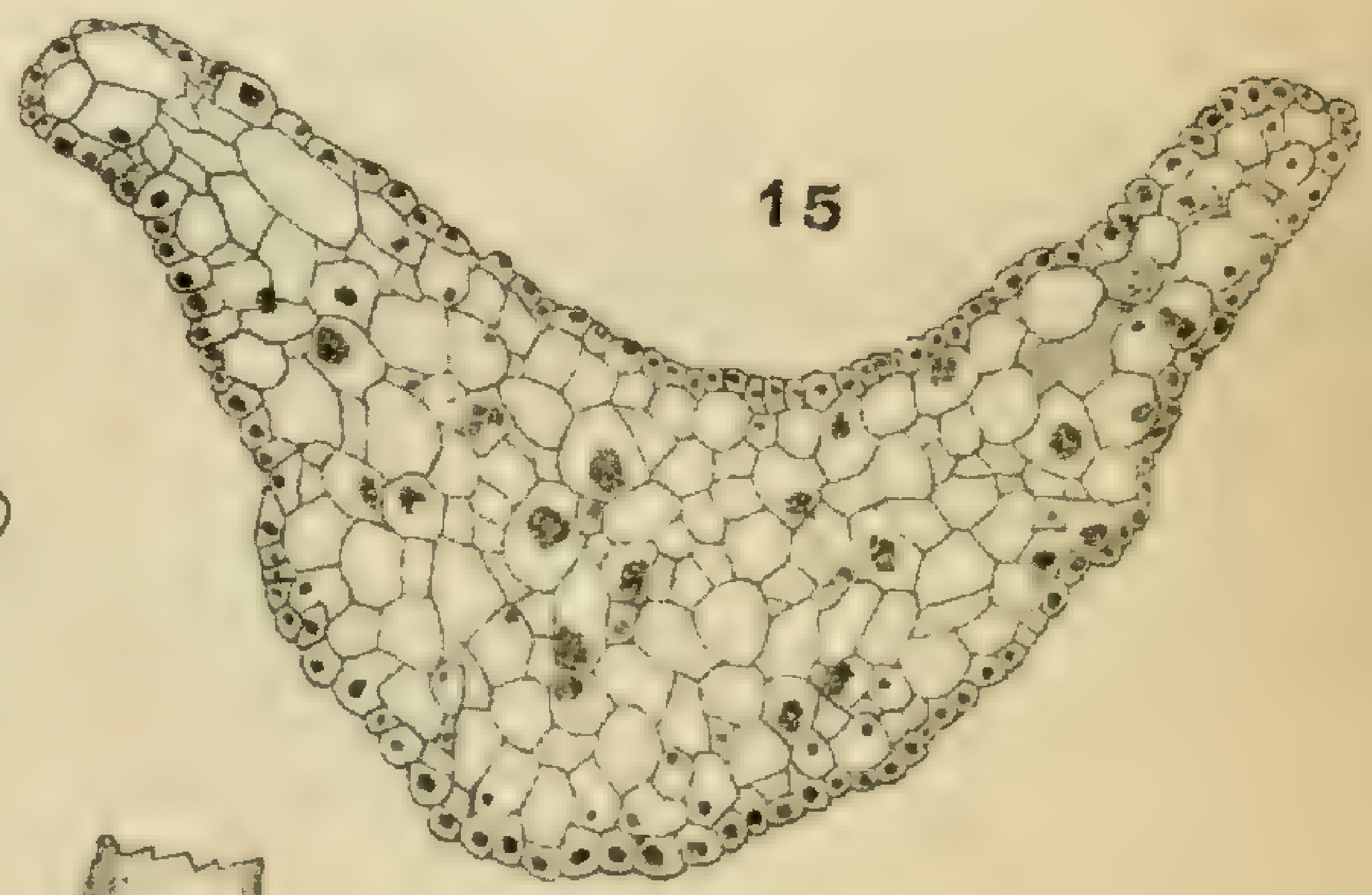
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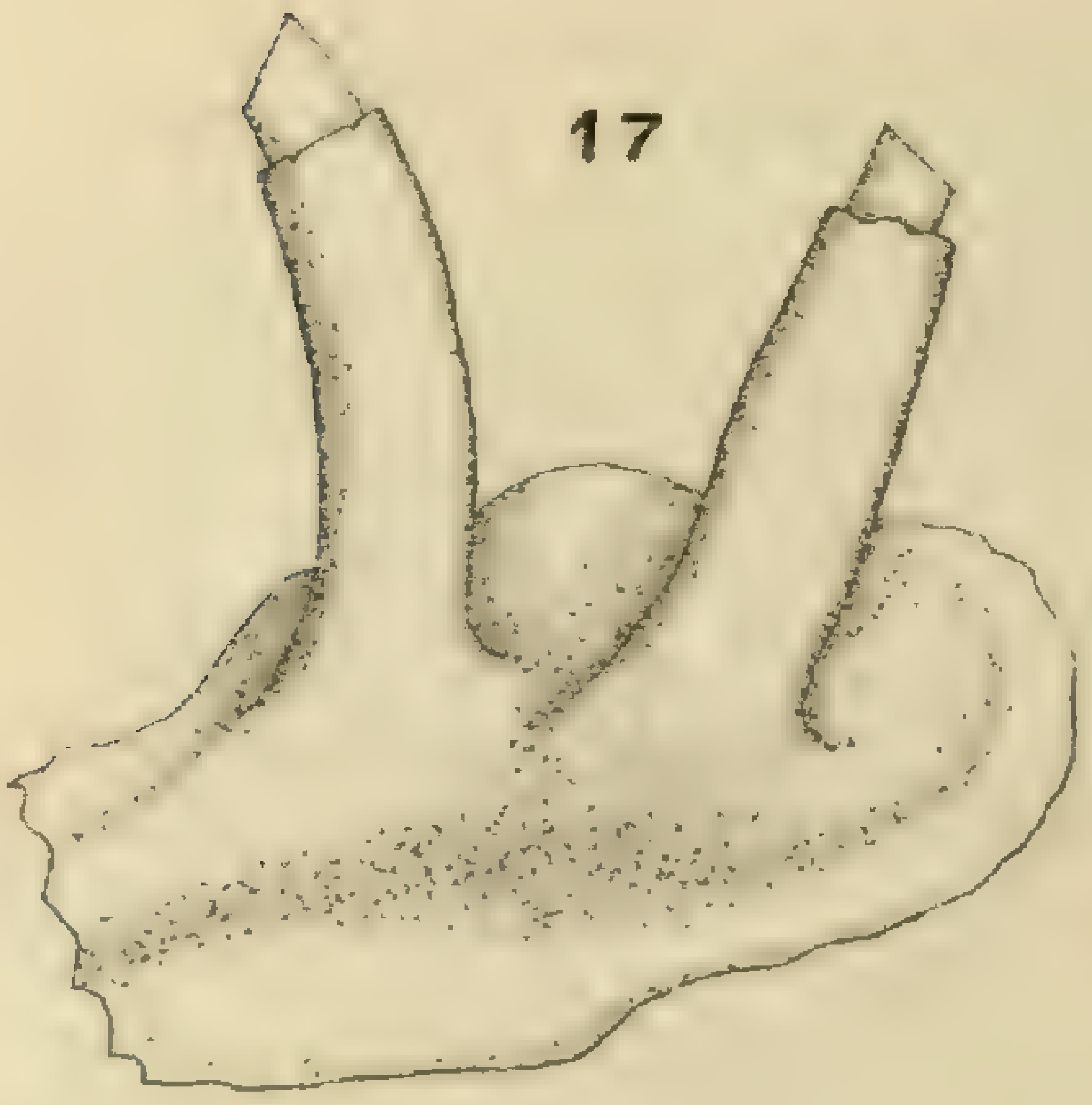
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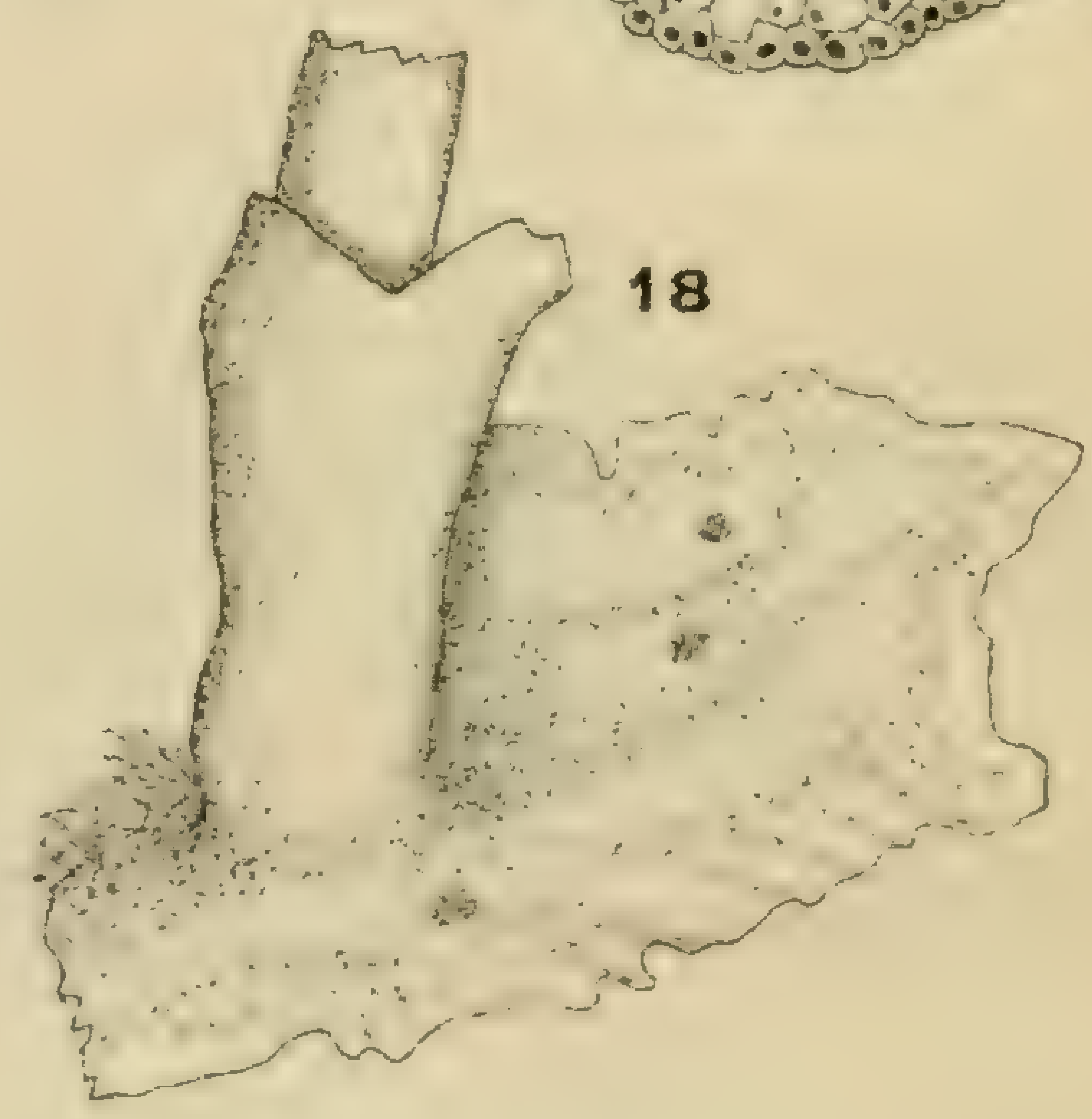
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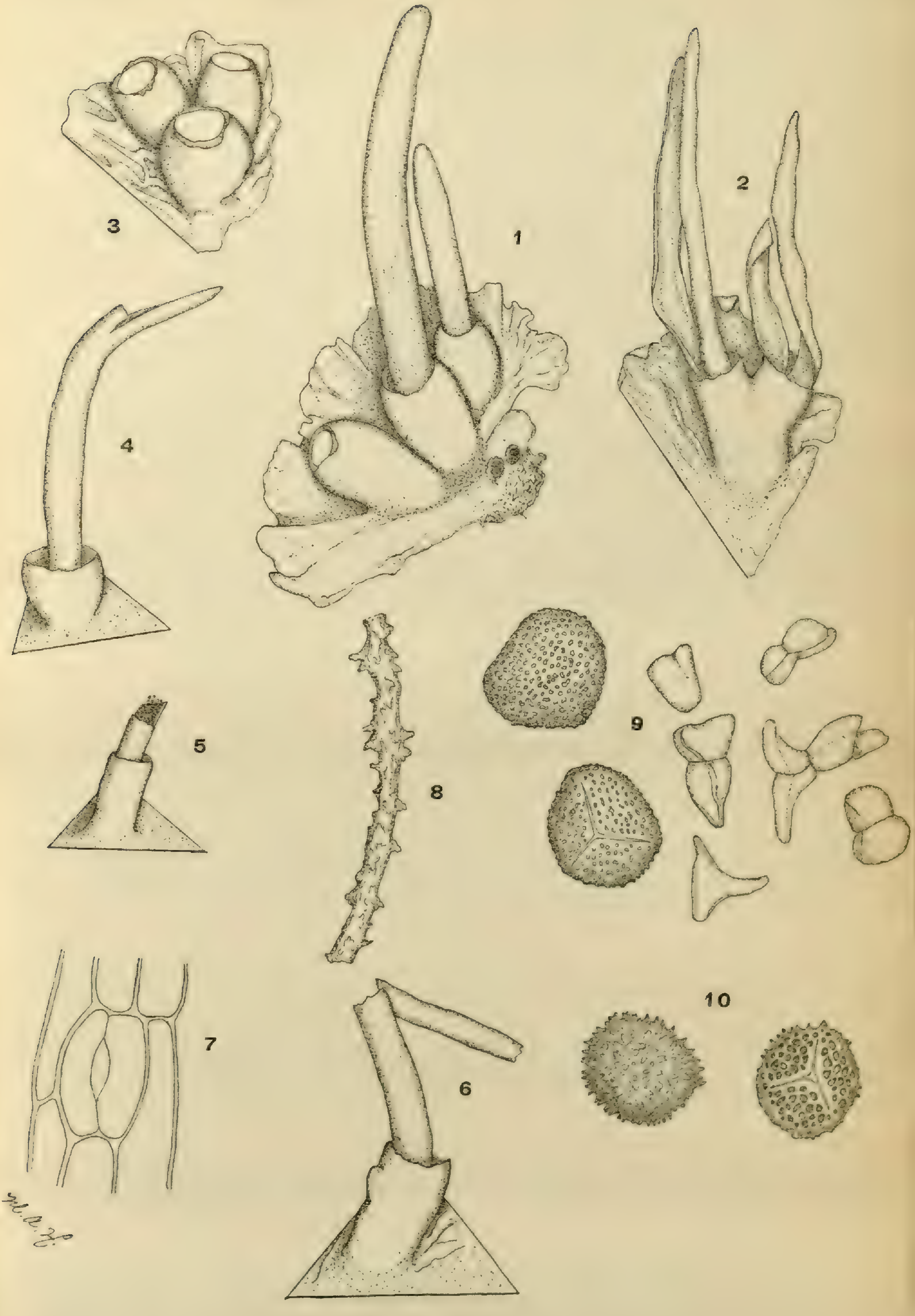
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BULLETIN
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FEBRUARY 1898

A Contribution to the Physiology of Tendrils.*

BY D. T. MACDOUGAL.

Entada scandens Benth. is an example of the group of plants which have developed climbing organs from leaves, and which exhibits the transition forms between the initial leaf and the tendril bearing organ.

The genus *Entada* includes five climbing species, some of which have the power of grasping supports by means of the stalks of the pinnae, the others have converted the terminal pair of pinnae into a highly specialized pair of tendrils. *Entada scandens* and *E. polystachys* belong to the latter class.

The adult plant of *E. scandens* consists of a roughened, thick, densely branching vine, which climbs over small trees and shrubs, attaining great distances and heights. In some instances the apex of the principal stem has been found 100 metres from the root.

The leaves are 15–30 cm. in length and consist of a short petiole and an elongated midrib bearing a terminal pair of cylindrical tapering tendrils 5–6 cm. in length. The base of the petiole forms a large pulvinus capable of movements through an angle of about 100 degrees in response to heat and light stimuli. The apical portion of the leaf bearing the tendrils is exposed and the tendrils become active before the pinnules are unfolded. The leaves are generally securely anchored before the green surfaces are de-

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* A preliminary notice of this paper was read before the Indiana Academy of Science, December 30, 1897.

[Issued February 12.]

veloped by this arrangement. If a tendril fails to grasp a support it soon dies and is cast away in the same manner as useless leaves or pinnae.

Concerning the history of the development of tendrils on seedlings, Schenk says "Von *Entada scandens* habe ich eine Keimflanze im Bonner Bot. Garten beobachtet. Aus dem dicken grossen Samen kommt ein langer dünner Hauptstengel hervor, dessen erste Blätter keine Spreiten entwickeln, sondern am Ende des Stieles nur je eine Doppelranke tragen. Erst wenn der Stengel einige Fuss hoch ist, folgen auf diese rankenartigen Niederblätter normale gefiederte Blätter mit endstandiger Doppelranke."*

Seedlings grown in a plant house at the University of Minnesota exhibit four or five basal club-shaped bracts attaining a length of 8 or 9 mm. before dropping away. The fifth leaf consisted of a short midrib bearing a pair of irregular stubby pinnae 2 mm. in length, near the base, and a pair of tendrils springing from a point 1 mm. from the tip of the midrib. The basal pinnae bore lateral papillose extensions 8 mm. in length representing pinnules. The tendrils attained a length of 7 mm. and assumed the normal position but were not at any time capable of reaction or of grasping an object. The entire petiole and midrib measured 17 mm. and reached its maturity at a time when the plant stood 19 cm. above the ground. The sixth leaf was furnished with two pairs of lateral branches beside the apical pair of tendrils. In other plants the imperfect tendrils or the branching of the rudimentary rachis did not occur until the sixth leaf had appeared. The leaves successively increased in size and were functionally perfect both as to tendrils and laminae at a varying distance from the base.

Anatomy.

The tendrils are tapering cylindrical, 5–6 cm. in length, when first exposed they adhere by the adjoining surfaces in such manner as to present a D-shaped outline, and do not separate and become irritable until a length of 1.5 or 2 cm. is attained. In the mature tendril the arrangement of tissue is strictly isodiametric. A radius of the cross section would expend one-sixth of its length in passing the medulla and xylem, two sixths in passing through the phloem and three sixths in the cortex and epidermis. The structure allows great flexibility, rapidity of reaction, and admits of curvature in any direction. A further adaptation to these demands consists in the extremely small size of the cells.

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* Beiträge zur Biol. d. Lianen 1: 155. 1892.

The epidermal cells are rich in protoplasm, the outer walls are markedly outwardly convex, and the three diameters of the cell are nearly equal. The cortical cells impinge directly on the epidermis, and a most notable fact is the entire absence of an external layer of collenchyma. The cortex contains a large amount of chlorophyl and the globoid cells are arranged in six to eight layers with marked intercellular spaces. The inner boundary of the cortex is marked by a sheath consisting of one to three layers of cylindrical parenchymatous cells completely filled with a densely granular substance resembling the gluclosides. Similar cells occur in the phloem and even in the xylem. The medulla is composed of very small elongated cells which have become sclerotized. The tendril then consists mechanically of a cylindrical core of mechanical elements enclosed in a thick cylinder of motor tissue, both of which have a strictly radial symmetry.

IRRITABILITY.

The tendrils appear equally sensitive over their entire length and at a temperature of 33° C. react to contact after a latent period of 5–10 seconds and regain the original position in 10–12 minutes if the contact is but momentary. If a tendril is pressed by means of tweezers or the thumb and finger, no curvature is induced, since the organ is equally stimulated to curve in opposite directions.

When plants growing in the open air are examined, it is difficult to find them in a "normal" or unirritated condition, since they are in a state of rapid circumnutation, are very flexible and easily swayed by the wind; then the contiguity of the two tendrils in a pair allows them to be thrown together very easily. As a result of these facts, the tendrils are generally more or less curved into a hook form, in which condition they will more readily grasp a twig or other support. The most advantageous position in general would be when the organs are separated with their axis forming an angle of 45 degrees, and the tips curved in any direction except toward the other tendril. If the movements of the leaf should bring a branch between the arms of the Y thus formed, it will be enclosed in 50 to 80 seconds, which is perhaps the most efficient work of any climbing device.

THE SENSORY ZONE.

The sensory zone apparently consists of the single layer of epidermal cells. These cells, seen from the surface, exhibit the greatest diameter tangentially, and seen in cross section the diameters are nearly equal. The nucleus occupies a central position, and the ectoplasmic layer on all sides is extremely thick and very densely granular. It is of course impossible to discover the condition of these elements in an unstimulated condition.

The outward convexity of the external membranes would offer most advantageous conditions for the appreciation of delicate stimuli. The contiguity of the motor cortex cells with numerous interprotoplastic connections would facilitate the transmission of impulses.

MECHANISM OF CURVATURE.

The method of production of curvature was determined by measurements of the cortical and epidermal cells of the convex and concave sides of curved tendrils and comparison of the same with data obtained from straight organs. The measurements of one set are given below:

TABLE I.

Measurements of opposite sides of straight organs.

	Number of Cells.	Length.	Average.		Number of Cells.	Length.	Average.
Epidermis	8	707	12.1	Epidermis	9	100	11.1
	5	102	20.4		5	100	20.
	4	96	24.		6	100	16.6
(A)	4	104	26.		4	110	27.5
Epidermis	10	100	10	Epidermis	10	100	10
	7	100	14.3		6	98	16.3
	6	94	15.6		6	100	16.6
(B)	4	94	23.5		4	98	24.5

TABLE II.

Measurements of tendrils stimulated and quickly killed. Sets of cells directly opposite in the same section were measured.

Convex Side			Concave Side		
Number of Cells.	Length.	Average.	Number of Cells.	Length.	Average.
Epidermis 10	100	10	Epidermis 12	100	8.3
8	95	11.9	7	100	14.3
6	100	16.6	8	105	12.5
4	100	25	9	100	11.1
Epidermis 10	100	10.	Epidermis 12	100	8.5
8	105	13.1	8	100	12.5
5	104	20.8	7	108	15.4
5	95	19.	7	100	14.3
3	100	33.	5	100	20.

The average length of the four sets of cells of a straight tendril were 19, 17.8, 14.5, 15.6 with a grand average length of 16.725. The average lengths of the cells from the convex sides were 14.5 and 16.2 with a grand average of 15.15. The average length of the cells from the concave sides of the same tendrils were 11.25 and 13.

It is found, as a result of these measurements, that the cells of the concave side have undergone such diminuition in the longitudinal axis as to measure less than the average normal cells and less than the corresponding cells of the convex side. The cells of the convex side have not increased beyond the average of normal cells. It is evident, therefore, that the curvature of the tendrils is to be ascribed to the action of the cells becoming concave. This action presumably resembles that of the pulvinus of *Mimosa*. Such mechanism is in fact demanded by the structure of the tendril and the rapidity of the curvature necessary to make the motion efficient and economical.

Morphological Changes due to continued Pressure.

The greater portion of the tendril is usually engaged with the support and the free basal portion is rarely a centimeter in length. After the apical portion has engaged the support the basal portion becomes curved in some instances sufficiently to form one complete spiral. In no instance, however, was the arrangement of the freely curved base sufficient to give an elastic or springing attachment of the leaf which is, in consequence, held in its position quite rigidly.

The portions of the tendril in contact with the support show an increased diameter and a general thickening of the cell walls. The contents of the glucoside cells have nearly disappeared, suggesting that this substance functions as reserve material.

In the outer region of the glucoside cells a ring of libriform tissue is formed which is four or five layers in thickness on the concave side and scarcely half as much on the convex. This ring, as well as the woody, is lignified. The cortex has increased in thickness by simple enlargement of cells. The subepidermal layer has perhaps undergone division forming irregular and much compressed cells. The cells of the epidermal layer of the concave side have undergone enlargement in a radial direction so that this diameter is two or three times as great as the diameter parallel to the surface of the organ. The increase is principally in the form of a greater convexity of the outer wall. The entire concave surface of the tendril has epidermal cells forming irregular papillae, consisting of a group of six to fifty cells. Such an arrangement would fasten the organ quite firmly to the support. The epidermal cells of the convex side have undergone no marked changes except in increase in the axes parallel to the surface and decrease of the convexity of the outer walls.

General Conclusions.

Schenk has pointed out that the theory of Darwin, that all tendril-bearing plants were originally twiners, is at least not applicable to leaf-climbers, and to climbers with tendrils derived from leaves. Leaf-climbers were doubtless derived from species with elongated weak internodes which grow up through the tangles of jungles. The weight of the stem would be supported upon the neighboring plants by means of the leaves and other lateral members. The movement of the surrounding plants by the wind would tend to produce injuries in the supporting members. The development of the power of response to contact would enable the ancestral climbers to avoid this injury, and at the same time climb more effectively. The development of the irritability to contact in the extremities of the leaf and the transformation of such members into filiform organs would be a natural consequence, and an inevitable one in species bearing large or extended leaves, such as the one under consideration. Furthermore, the general phylogeny of *Entada* would not indicate that it has been a twiner at any time in its existence.

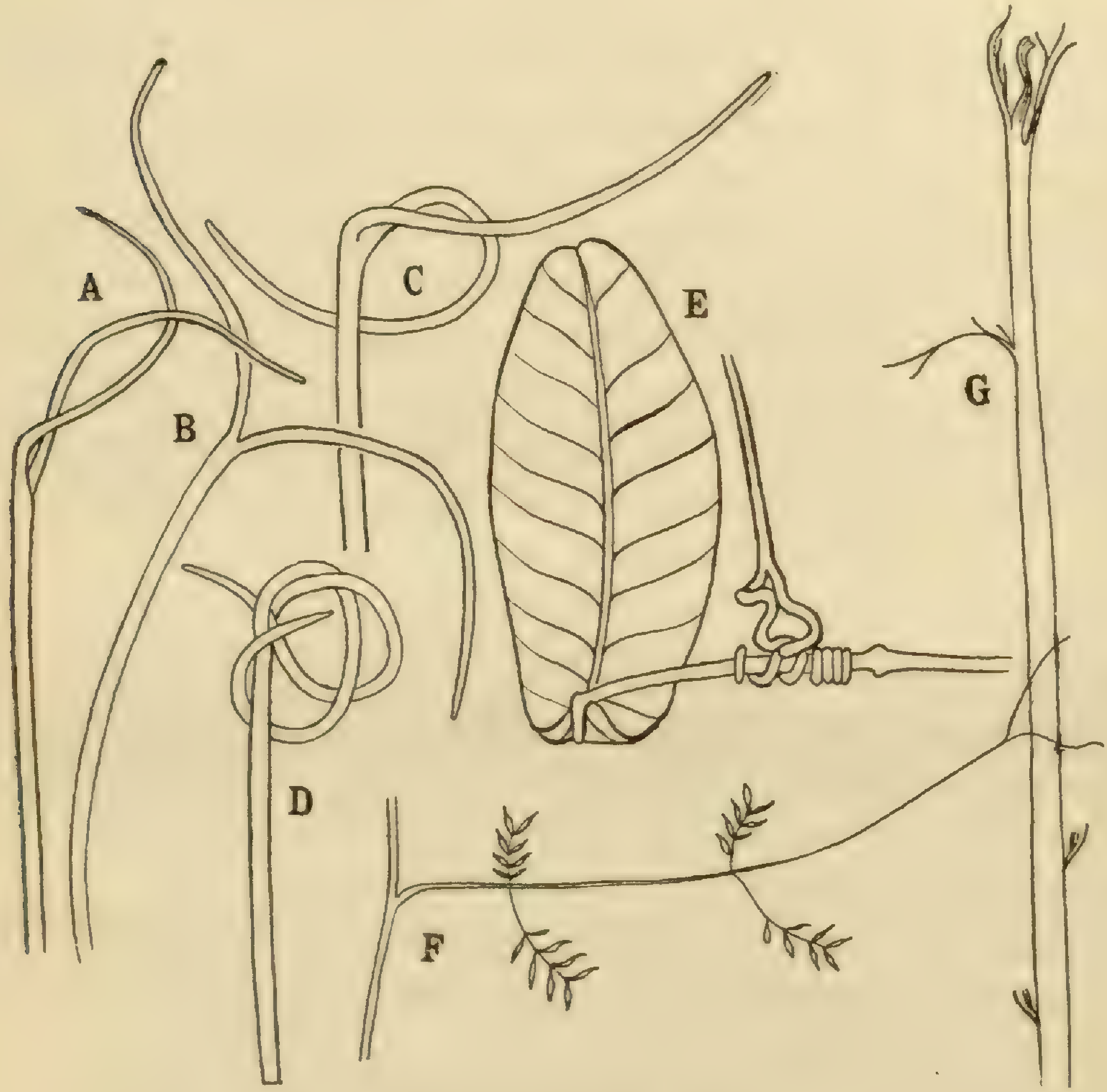
A consideration of the features of the irritability of the tendril leads to the conclusion that the efficiency of the tendril is by no means dependent upon the degree of dorsiventrality exhibited. The isodiametric tendrils of *Entada* are quite as effective in grasping supports and exhibit as great a degree of delicacy of sensorial action as any organs yet examined, and they show no tendency toward dorsiventrality.

Dorsiventrality is induced only by pressure of the support where it is of some benefit in securing a firmer hold. The delicacy of reaction depends more upon centralization and concentration of the woody cylinder, a fact to which I have previously called attention. The lack of collenchyma in the tendrils of *Entada* is probably due to the almost entire absence of torsional strains during the curvature of the tendril. The collenchyma sheath of many tendrils is doubtless to resist the effects of torsional strain. Attention is to be called here to the fact that, in the tendrils of *Entada*, nearly the entire length of the tendril engages the support in a single continuous spiral, and free coiling forms only part of a circle in the basal portion of the organ.

The mechanism of curvature is seen to resemble that of tendrils of *Passiflora* and the roots of *Zea*, in which the mechanical elements are centralized and in which the motor tissue occupies a relatively great portion of the cross section. Curvature is effected by the contraction of the cells of the side becoming concave, a condition demanded by the rapidity of reaction.

The work recorded in this paper was largely performed in or near the botanical gardens at Castleton and Bath in Jamaica, in the summer of 1897, and the writer is indebted to Hon. Wm.

Faucett for the privileges of the gardens, access to collections and much valuable information.



Explanation of Figures.

The tendrils of *Entada scandens* Benth.

A–E, illustrating positions taken by tendrils. A and C, position resulting from mutual stimulation and nutation. B, normal or unstimulated tendrils. D, curvatures produced by filaments of spider's web. E, tendril attached to leafy branch of supporting plant. F, compound leaf with terminal pinnae converted into tendrils. G, shoot of seedling. The fifth leaf exhibits a terminal pair of tendrils and a single pair of foliar pinnae.

Contributions to Japanese Characeae.—III.

By T. F. Allen.

A.—NEW SPECIES OF NITELLA.

The following Japanese species of *Nitella* seem to belong, properly, to the subdivisions *diarthrodactylae*, *homoeophyllae*, *monoicae*, *subflabellatae*, *congestae*, *microsporae*. This group, founded on *N. axillaris* A. Br. (from Caracas, S. Am.), is, in general, characterized by a condensation of the fertile verticils in close spike-like racemes (the new *N. rigida*, *Saitoiana* and *Tanakiana*); or in dense axillary clusters (*N. axillaris* A. Br. and *N. Morongii* Allen).

The group has been divided by Nordstedt into two: (1) With small spores, 290 to 340 long, and (2) With large spores, 400 to 450 long; the capitula of the latter are either terminal or axillary. The species with smaller spores may be arranged as follows (according to size of spore): 250, *N. Morongii* Allen; 275, *N. Saitoiana*; 285, *N. rigida*; 290, *N. axillaris* A. Br.; 306, *N. Tanaykiana*; of these *N. rigida* Allen bears fruit in elongated axillar, and terminal spikes; *N. Tanakiana* Allen also, but the spikes are rather like condensed upper verticils; *N. Saitoiana* Allen has more open upper fertile verticils; while *N. Morongii* Allen bears fertile verticils in dense axillary clusters.

NITELLA RIGIDA sp. nov.

Plants erect, strict, almost rigid, 15–20 cm. long; branches strictly erect, not spreading, lower sterile leaves 4 to 6 in a whorl 6–8 cm. long; divided near the apex into 3–5 short branches, which usually are once again divided into two short terminals. From the sterile verticils, long "spikes" of fertile leaves arise, which may exceed the length of the stem; the fertile verticils are at first remote, but become crowded above; the entire "spread" of a fertile verticil is scarcely more than 3 or 4 mm.; the fertile leaves, usually 5 in a whorl, are 2- (rarely 3-) divided; the first segment 54–60 in diam.; *the first node* bears 5 divisions; *the second node* carries 2 or 3 terminals; the second segment of the leaf is 45–60 in diam.; the terminals are about 25 in diam., rarely 3-celled and very rarely subdivided; the ultimate cell is a mucro 15 at base by 100 long; the oögonia are single at the node of the leaf, tapered; the oöspore is 285 long by 272 broad, with five rarely six, prominent, sharp ridges; the membrane of the spore is covered by papillae, not pointed, about 1 μ long and about three in 5 μ; the antheridia are about 160 in diam., varying with age.

Collected in Shakuhachi pond, Kyoto, Japan.

NITELLA TANAKIANA sp. nov.

Plant 20–25 cm. long, rather simple, sparingly branched; verticils of two sorts quite distinct, lower sterile remote, consisting of six leaves divided near the end into 2 or 4 shorter terminals, 6 or 7 mm. long, which are often again subdivided; the terminals are, as a rule, 3-*celled*, the ultimate cell a mucro; the upper fertile leaves are very short, and at the upper part of the stem the verticils become gradually smaller and closer or elongated shoots arise from the lower sterile verticils and bear only close whorls of fertile leaves (having the appearance of spikes); the fertile leaves are 2-divided (very rarely, a third division has been seen); the *first node* consists of 3 or 4 divisions, the second of 2 or 3 (rarely 4) unequal terminals; the terminals are 3-celled (with only an occasional exception) the first cell *two-thirds the length of the entire terminal*, the second cell tapering somewhat to the third which is a mucro; the stem is about 333 μ in diam.; the first segment of a leaf 130, the second 116 to 58, the third 75 tapering to 50, the mucro, almost triangular, 30 to 45 at base and 80 to 116 long; the mucro drops easily and early; mature leaves are rarely found with mucrones.

The species is monoecious; oögonia occur on both nodes of the leaf ,often aggregated. The oöspore is 306 long by 272 broad, with 6 (or 7) sharp and prominent ridges. The membrane is characterized by granulo-reticulate markings, small pointed granules are arranged in reticulated series with a faint connecting line, and with larger granules at the junction of the irregularly hexagonal reticula.

The relationship of this interesting species seems clearly to be in the group with *N. rigida* Allen, from which it differs by its more flexible habit, the character of the terminals and of the oöspores

This plant was collected in Hirosawa pond, Kyoto, Japan.

NITELLA SAITOIANA sp. nov.

Plants 15–20 cm. long, somewhat branched, with numerous whorls of long leaves which become crowded and abbreviated above. In the lower part of the stem the verticils are 3–4 cm. distant, the leaves about 3 cm. long, equaling the length of the internode. The lower leaves are sterile and divided above the middle into 3 or 4 segments, which area gain divided (usually) into 2 or 3 very short mucronate terminals. The leaves of the upper verticils are shorter but still diffusely spreading and not condensed into a congested mass; they are 2-, rarely 3-divided; the *first node* bears 3–5 divisions and is at times fertile, the *second* 2 or 3, and the *third*, when present 2 (rarely 3 terminals). The stem is 400 in diameter, the verticil consists of 7 or 8 leaves; the first segment of the leaf is 286 in diameter, the second 200, the third 143 and the terminal 143. The terminal is frequently 3-celled, the division being ¾ near the upper extremity; it does not taper markedly to the mucro. The mucro is about 25–35 in diameter to 70–80 long, not very evanescent. The antheridia are about 225 in diameter. The oögonia are isolated usually, but often aggregated at both nodes, more often on the second node. The oöspores are 275 long by 240 broad, with five or six ridges; the membrane is marked by long and short granules irregularly arranged.

This species seems to belong in a group with *Nitella rigida* and *N. Tanakiana*, and to be slightly related to *N. gracilis;* from the former species it is distinguished by its more diffuse habit, the fertile verticils not on spike-like shoots, from *N. gracilis* by numerous characters, though the tendency to the *three-celled* terminal is seen in all these species.

Collected in Sweibachi-ike pond, province Kyoto, Japan. Named for a faithful and industrious collector, Kenzo Saito.

B.—NOTE CONCERNING NITELLA ORIENTALIS ALLEN, WITH DESCRIPTION OF A NEW ALLIED SPECIES.

NITELLA ORIENTALIS Allen, Bull. Torr. Bot. Club, 21: 524. 1893.

This plant varies greatly from different localities, not only in size, but in the divisions of the leaves. The leaves are often only 3 times divided, often 5 times; the terminals, often very short (brachydactylae) are again quite long (macrodactylae), so that I have been in doubt about referring the species to the "*polyglochin*" series. The antheridia vary from 75–300 in diameter. The oögonia are usually clustered, but sometimes isolated *never on the first node;* the oöspores vary from 340–375 long and 285–320 broad, always with 7–9 ridges. The surface of the spore seems to have a superficial and dense grumous layer of felted fibres, covering a granulated surface, but the granules are not pointed and do not protrude through the felted layer.

This species seems to me to belong rather to the *macrodactylae* division, and to be allied to my new *N. expansa*, to which its similar habit of growth associates it. Formerly, owing to the very unequal and extremely abbreviated terminals, I referred it to the *brachydactylae* section with which it seems ill-assorted.

N. orientalis and *N. expansa* are similar to *N. gracilis* in habit of growth, but the oögonia are clustered and the oöspores differ. The divisions of the leaf and the character of the terminals also separate these two species. The tendency to abbreviated terminals and to more than three leaf-nodes in *N. orientalis* points to a sort of transition to the species of the *brachydactylae* series (which abound in Japan).

NITELLA EXPANSA sp. nov.

Plants 10–12 cm. high, diffusely branched, "bushy;" leaves spreading, diffuse, stem 450 in diam; verticils approximate, of 5 or 6 leaves; leaves spreading, often longer than the internodes, 3 (rarely 4) times divided; the first segment less than half the length of the entire leaf, 200–265 in diam; the first node, with 5 or 6 divisions, usually sterile; the second segment 160–170 in diam; the second node, *with three divisions*, fertile; the third segment 145–155 in diameter; the third node, with 2 or 3 divisions, fertile; the fourth segment, 100–120 in diam., usually terminal. The mucro, 34 in diam., 80–100 long; the terminals are unequal, 1–3, often very short; the oögonia are usually isolated, but often aggregated on the second and third nodes, *not seen on the first node, but often found in the verticil, on the stem.* The antheridia about 200 in diameter; the oöspore 245 to 250 long by 204 to 220 broad, with five or six sharp ridges, at second and third nodes, the surface *quite smooth.*

In its aspect it is quite similar to *N. gracilis;* the first node of the leaf also bears four divisions and is sterile. It is similar to *N. orientalis* in the unequal terminals, one of which is often very short, but the second node of this species is 3-times divided and the oöspore is smaller with a smooth surface (granular in *N. orientalis*).

Collected in "Shakuhachi-bori water," Kyoto, Japan.

C.—DESCRIPTION OF A NEW JAPANESE NITELLA ALLIED TO OUR AMERICAN SPECIES, N. TRANSILIS ALLEN, AND N. TENUISSIMA DESV.

NITELLA GRACILLIMA sp. nov.

Plants very delicate; 6 to 8 cm. high; branched, but not diffusely; branches and leaves mostly rather erect, not spreading; stem 80 to 90 μ diam.; verticils consist of 6 leaves; leaves somewhat erect, not diverging from the stem, not quite equal to the internode (aspect of *N. transilis* Allen); leaf usually thrice divided; the *first segment* nearly half the length of the entire leaf; 54–60 in diam.; *first node* has 6–7 divisions; sterile; the *second segment*, shorter, 40 to 48 in diam.; the *second node* bears four divisions, fertile; the third segment, 30 to 35 in diam.; the third node, fertile, bears 4 or even 5 terminals; the terminals slender, longer than the preceding segment and nearly as long as the first, 34 in diameter, one-celled, except the mucro, which is about 15 in diameter by 55 to 68 long (large for the size of the plant).

The oögonia are isolated at the second and third nodes of the leaf; the oöspore is 190 to 197 long by 150 to 156 broad, with six or seven sharp wavy ridges. Antheridium 125 to 135 in diam. The *spore membrane is remarkable in being covered with coarse elevated elongated granules.* The ridges are acute at their tops, but spread at their bases, where they join the surface of the shell; these bases are wavy-toothed. The granules are often very short, almost oval, often elongated even to a length of five mikrons.

This species approaches *N. transilis* Allen, differing in its greater tenuity, *much smaller oöspore*, with a different spore-membrane.

Collected in "Shinbashi water" province of Mikawa, Japan; mature in December.

D.—DESCRIPTION OF NEW VARIETIES AND FORMS OF NITELLA PSEUDOFLABELLATA A. BR. FROM JAPANESE WATERS.

The name was given by A. Braun to the species collected by the Prussian expedition to eastern Asia, 1866. This was formerly confused with *N. flagelliformis* (*N. dispersa* A. Br.) from Java, in Lake Telaga Padenga (in Herb Van den Bosch) very elongated, one to two feet, relatively slender, verticils remote with condensed and tangled leaf-tips, so differing from *N. gracilis*, also blackish-green, flexible. * * * Fertile leaves three- or even four times divided. *The first segment of the leaf distinguished by its length, as long as, or longer than all the divided part of the leaf.* First division into five or six rays, of which one or two may be simple, the remainder further divided; the succeeding segments becoming shorter, but the last again longer. * * * Java: China: Bengal: Borneo, var. *mutila* A. Br.

In his Characeae Nov. Zeland. in Act. Univ. Lund, 1880, Nordstedt publishes a description of a *forma mucosa* and considers it a possible new species.

The elongated first member of the leaf is taken to be a feature of this species; it determines the peculiar aspect of the plant when growing and is quite unique.

NITELLA PSEUDOFLABELLATA IMPERIALIS var. nov.

Plants 20–25 cm. long; stems usually simple, 540 μ in diam Verticils remote (in the middle portions, 3–4 cm. distant), 12–15 mm. in diam. Leaves 5–8 mm. long: *first segment longest* (*longer than half of the entire leaf*, about 220 μ in diam.: second segment 102 in diam., about 1200 μ long; third segment 68 in diam., 540 long; fourth segment 54 in diam., about 600 long (if divided), when the fifth seg. becomes terminal it is about 800 long. The leaf bears three, and frequently four nodes, the *first is sterile usually*, and bears 6–8 rays; the *second* node, fertile, bears 4–5 rays, some of which may be undivided. The *third* node, also fertile, carries 4 or 5 rays, and these are frequently again divided, this *fourth* node bearing three (usually) terminals. The mucro is pronounced, about 27 in diam. at base, by 82–102 long. *Fruit mostly on the second and third nodes* (*not seen on the first* or last nodes); *oögonia isolated*, oöspore black, with seven or eight pronounced ridges, 326 long, 272 broad. Membrane covered with a fine close felt of fine hairs.

The membrane of the spore is most similar to the specimens from Hong Kong, and differ from those from Australia, New Zealand and Java by not having, in addition to the "felt," short spines. In the size of the spores and the character of the membrane it cannot be separated from the Chinese form. These plants from Japan seem to be covered with mucus, which, when dried, causes a glistening appearance to the specimens and glues them tightly to the paper. Collected in Mishitani pond, Fujisato village, prov. Ise, Japan, in September.

While the similarity in the oöspore connects this form with the Chinese form, the Japanese plant is strikingly different in its general habit, and following the advice of Nordstedt I give it a distinct varietal name *imperialis*.

NITELLA PSEUDOFLABELLATA RAMUSCULA var. nov.

Plants about 15 cm. long, diffusely branched, slender, about 400 μ in diam. Verticils often crowded (the leaves exceeding the length of the internodes), consisting of 8 leaves. The leaves are 5–8 mm. in length; *the first segment longer than half the length of the leaf*, 175–220 in diam. The leaf is usually thrice divided;

the *first node sterile*, bears 6–7 rays; the *second, fertile*, bears 5 rays; the *third* node, *sterile*, bears 2–4 simple, two-celled, terminal rays. *In fertile leaves these terminals are again divided, but rarely.* The *second segment* is shorter than the first, 75–80 in diam.; the third is about the length of the second, 48 in diam. Occasionally a ray of the second, fertile, node is undivided and elongated to equal the length of the terminal rays. The mucro is 20 in diam. at base and 70–80 long. The antheridium is about 125 in diam. *The oögonia are isolated at the second node, only;* the oospore 292 long by 272 broad; with 7–8 faint ridges. The surface of the colored membrane is marked by faint granules, in very low relief, the tops of the ridges are dotted with more prominent granules irregularly disposed, almost as if toothed. From the type this variety differs in its more diffuse habit, the *size of the oöspore and by the markings on its surface.*

The plant was gathered in Shakuhachi pond, Kyoto, Japan.

NITELLA PSEUDOFLABELLATA RAMUSCULA Allen *forma testa-glabra.*

Plants about 30 cm. long, slender, lower verticils remote upper becoming crowded, sparingly branched, stem about 500 μ in diameter. The verticils consist of 8 leaves. The leaves are thrice divided (very rarely four times divided). The first segments of the leaves are quite long, *about four-fifths of the entire leaf*, 150 in diam. *The first node is sterile*, and consists of 6 or 7 divisions; the *second* node, fertile, has four (usually, rarely 6) divisions, with an occasional undivided terminal ray; the *third* node, sterile, bears three to four terminals. The second segment of the leaf is usually short, 80 in diameter, the third segment is longer than the second about 54 in diameter; the fourth (and fifth, when present) are terminal, 50 in diameter, tapering to the end; the mucro 20 μ in diameter and 60 long. The antheridia are about 136 in diameter; *the oögonia isolated on the second node only.* The oöspores are 285 long by 272 broad with six faint ridges; the colored membrane of the oöspore is *perfectly smooth.* No indications of mucus have been found on either of the forms in this variety.

Gathered in Mizoro pond, Kyoto, Japan.

E.—A NEW DIVISION OF THE FLABELLATAE-MACRODACTYLAE SPECIES OF THE DIARTHRODACTYLAE SECTION OF NITELLA.

The species now known, have been classified as (1) *Subflabellatae*, leaves once or twice divided, and (2) *Flabellatae*, twice, thrice or even four times divided. While these divisions cannot be sharply defined, they have served to embrace our known species and furnish places for many new ones; but a few new forms have come to hand with *leaves many times divided*, with more than four or even six nodes, and it would be convenient to enlarge the bounds to admit them. They cannot be referred to the *brachydactylae* group for they belong to the *macrodactylae*. They do not consort with the forms of *N. pseudoflabellata* A.Br., for the leaves differ in appearance, especially because the first segment of the leaf is not longer than half of the whole divided leaf; so I propose a new subdivision, *Perflabellatae*, *with leaves 4 or more times divided*. The new arrangement is as follows:

1. *Segments of the second division of the leaf, commonly 2 or 3; primary segments not longer than half the divided leaf* (*N. mucronata* A. Br., *N. expansa* Allen, etc.). § 1. FLABELLATAE.

2. *Secondary segments commonly 4–6; primary segments longer than half the divided leaf* (*N. pseudoflabellata* A. Br. and varieties). § 2. PSEUDOFLABELLATAE.

3. *Secondary segments commonly 4–5; primary segments not longer than half the leaf. Leaf many times divided with 4–6 or more nodes.* § 3. PERFLABELLATAE.

Since the forms of the last section are somewhat similar in habit, have a similar oöspore-membrane, and the first node is usually *sterile* and the *oögonia isolated*, I have placed them under one species, with three varieties as follows:

NITELLA MULTIPARTITA sp. nov.

Plants elongated, 40 cm. or more, flexible, branching from nearly every verticil. *Verticils* somewhat remote (at centre of stem) of 6–8 leaves which spread from stem. *Leaves* about 2 cm. long. First segment *almost*, but not quite, half the combined length of all the divisions of the leaf; divided *four* or even *six* times; *first node*, bears 6 to 7 segments, *sterile*; second *node*, *fertile*, bears 4 or 5 segments; *third node*, sterile or fertile, bears 4 segments; *fourth node*, bears 4 segments; *fifth node*, bears 3 segments; *sixth node*, bears 2 or 3 terminals. The mucro is 30 μ in diameter, by 54 long. *The first node is always sterile. The oögonia are isolated* at the second node, rarely also on the third node. The oöspores are 275 to 300 μ long, and *240* to *290* broad, *with 7 or 8 rounded ridges*; the membrane is evenly granular with about three granules in 5 mikrons.

Collected in "Obitorinoike water," Kyoto, Japan. Mature in July.

The following forms coincide with the type in having leaves with 4 to 6 nodes; the *first node always sterile;* the oögonia isolated at the second and third nodes and the spore-membrane granular.

As regards division of the leaf, the type has six nodes: *f. suberecta* and *f. intermedia* have each five and *f. transiliforma* four. In respect to size the type is more spreading and longer, *f. intermedia* is coarser and *f. transiliforma* the most delicate; as to oöspores *f. intermedia* reaches 306 μ long by 218 broad, while the others vary within the limits of 240 to 300 long by 224 to 290 broad; the granulation of the spore-membrane is tolerably uniform in all, but faintest in *f. suberecta.*

The mucrones vary from 48 by 15 *intermedia*; 61 by 27 in *suberecta*, 54 by 30 in the type and *f. transiliforma*.

NITELLA MULTIPARTITA Allen, *forma suberecta.*

Plants 15–20 cm. long, rather erect, sparingly branched; stem about 400–500 in diam. *Verticils* spreading, color dull yellowish green, more of the aspect of the forms of *N. pseudoflabellata* than of the bright, clear green of the succeeding form. Leaves bear, 4 or 5 nodes; *first*, with 6 or 7 divisions, *sterile; second*, 4 or 5 divisions fertile; *third*, 4 or 5 divisions, fertile; *fourth*, 3 or 4 divisions, sterile; *fifth* node with 2 or 3 divisions. The segments of the leaves vary, the *first* 2800–3300 long, 122 in diam., the *second* 1600–2600 long, 48–80 in diam.; the *third* 1400–2700 long, 54 in diam.; the *fourth* 500–2000 long, 40 in diam.; the terminals 170–240 long, 34 in diam.; the mucro 20–25 in diam. at base by 50–68 long. The oögonia are isolated; the oöspore 272 long by 245 broad, with seven faint striae, faintly granular.

Collected in Mizoro pond, Kyoto, Japan, in July.

NITELLA MULTIPARTITA Allen, *forma transiliforma.*

Plants about 20 cm. long, erect with about six verticils of bright green leaves. Verticils do not overlap; stem-nodes about 30–40 mm. distant, leaves about 25 mm. long. Stem sparingly branched, as a rule only near the base; stem and branches erect. Leaves slightly spreading, somewhat erect, forming a close verticil about the stem. Stem 400–500 in diameter. Verticil consists of 7 leaves. Leaves 3–4 divided; *first* node 6–7 divisions, *second* 3–4 divisions, *third* 2–3 divisions, *fourth* (when present) 2–3 divisions. The *first segment, less than half the length* of the leaf, 105 in diameter, the *second* 75, the *third* 50, the fourth terminal, 40 in diameter. The mucro 30 in diameter. The mucro 30 in diameter, by 54 long. The oögonia are *isolated* on the *second node only*. Antheridia not seen (plants mature and very fertile); oöspores 275–300 long by 240 broad with 7–8 blunt ridges: membrane of the spore evenly granular (about 3 granules in 5 *u*).

This form, it seems, cannot be separated specifically, though it is an apparent transitory form to N. *transilis* Allen. Like the latter species the leaves are sometimes only 3-divided, and it more resembles *N. transilis* in its fresh, bright green color with close, erect verticils than extreme forms of the type, with a flexuous prostrate habit, of a dull yellowish or brownish green color, with spreading verticils; but the character of the spores, the numerous transition forms and its locality connect it with *N. multipartita*.

The plants were collected in the same locality as the *f. intermedia*.

NITELLA MULTIPARTITA Allen, *forma intermedia*.

This form differs from the type in its more erect habit with less spreading verticils, fewer nodes on the leaves (4 or very rarely, 5); the plants are more slender though more erect, the diameters being as follows: *First* segment 306, *second* 140, *third* 82, *fourth* 61, *fifth* 48; the mucro 15 by 48. The oöspores are of the same size with the same character of ridges and sculpturings on their membranes.

Collected in Kyoto, Japan.

NOTE.—A number of etchings are being made to distribute with the separately printed copies; these will be sent cheerfully to all who may be specially interested in Characeae. T. F. Allen, 3 East 48th Street, New York City.

New or noteworthy American Grasses.—VIII.

By George V. Nash.

Andropogon Neo-Mexicanus sp. nov.

Culms from a perennial root, tufted, erect, smooth, glabrous and shining, branched above, 1 metre or less tall, the sterile shoots about one-quarter as long as the culms. Sheaths somewhat compressed, roughish, keeled, at least at the summit, shorter than the internodes; ligule scarious; leaves erect, rough on both surfaces, 8–15 cm. long, 3 mm. or less wide; racemes single, 4–5 cm. long, on long peduncles; internodes of the rachis from one-half to two-thirds as long as the spikelets, densely pilose on the angles with ascending white silky hairs. increasing in length toward the top, those at the apex 3–4 cm. long; spikelets in pairs, one pedicellate and consisting of a single subulate rough short-awned scale 5–6 mm. long, the pedicel about two-thirds as long as the sessile spikelet, clavellate, flattened, densely ciliate on the margins with long white silky ascending hairs; sessile spikelet perfect, a ring of short silky hairs at the base, the outer 2 scales lanceolate, acuminate, equal, glabrous, 8–9 mm. long, the third and fourth scales shorter, hyaline, delicate, cilicate on the margins, the latter deeply and acuminately 2-toothed for about one-third its length and bearing a rough geniculate awn 12–15 mm. long, spiral at the base and loosely twisted above.

Collected by Mr. E. O. Wooton on the White Sands, Doña Ana Co., New Mexico, on August 26, 1897. It belongs to the section *Schizachyrium*, and is related to *A. scoparius*. The profuse white silky longer hairs of the rachis internodes and of the pedicels, giving the racemes much the appearance of young specimens of *A. argyraeus*, furnish the most prominent diagnostic character.

Panicum Addisonii sp. nov.

Culms 2.5–4 dm. tall, tufted, erect or decumbent at the base, at length much branched, pubescent below with long nearly appressed hairs which decrease in length toward the summit where they are very short; sheaths usually shorter than the internodes, sparingly appressed-pubescent, at least the lower ones; ligule a ring of hairs; leaves erect, lanceolate, thickish, smooth and glabrous on both surfaces, rough on the margins, acuminate, 2.5–8 cm. long, 3–6 mm. wide; panicle ovate to oblong, 2–6 cm. long, its branches spreading or ascending; spikelets broadly obovate, 2 mm. long, the outer 3 scales membranous, the first scale ovate, acute or acutish, about one-half as long as the spikelet, 1-nerved, pubescent, second and third scales 9–11-nerved, densely pubescent with long spreading hairs, the fourth scale chartaceous, almost orbicular, enclosing a palet of equal length and similar texture.

Collected by Mr. E. P. Bicknell in sandy soil at Wildwood, N. J., May 30 and 31, 1897. This most distinct species is allied to *P. neuranthum* and *P. angustifolium.* It affords me great pleasure to name this interesting grass in honor of Hon. Addison Brown, president of the Torrey Botanical Club.

PANICUM COGNATUM Schultes, Mant. 2: 235. 1824.

Panicum divergens Muhl. Descr. Gram. 120. 1817. Not H.B.K. 1815.

Panicum autumnale Bosc; Spreng. Syst. 1: 320. 1825.

The name of Bosc, hitherto applied so generally to this plant, must give way to that of Schultes, published one year earlier, and based on the *P. divergens* of Muhlenberg, which, in turn, is invalidated by the previous publication of H.B.K. Muhlenberg's description clearly indicates this plant. The earlier name of Walter, *P. nudum*, is accompanied by so poor and inadequate a description that its reference to this plant would be mere assumption. The words of Walter's description, "*foliis caulinis nullis*," would certainly not be descriptive of our plant, in which the culm is quite leafy.

PANICUM EATONI sp. nov.

Panicum nitidum, forma densiflorum, Rand & Redfield, Fl. Mt. Desert, 174. 1894.? Not *P. densiflorum* Willd. 1825.

Smooth and glabrous; culms 4–10 dm. tall, erect, at length dichotomously branched and swollen at the nodes; sheaths much shorter than the internodes, usually more or less ciliate on the margins; ligule a ring of long hairs; leaves erect, lanceolate, acuminate, 4–10 cm. long, 3–10 mm. wide; panicle finally long-exserted, dense and contracted, 7–13 cm. long, 3 cm. or less broad, its branches erect-ascending; spikelets oval, about 1.6 mm. long, acutish, the first scale from one-fourth to one-third as long as the spikelet, glabrous, 1-nerved, the second and third scales broadly oval when spread out, 7-nerved, densely pubescent with spreading hairs, the fourth scale chartaceous, at length indurated, about 1.3 mm. long, oval, enclosing a palet of equal length and similar texture.

Along the coast, Maine to New York. I take pleasure in naming this grass for Mr. Alvah A. Eaton, who sent me specimens of it collected by himself at Seabrook, N. H.

PANICUM POLYANTHES Schultes, Mant. 2: 257. 1824.

Panicum multiflorum Ell. Bot. S. C. & Ga. 1: 122. 1817. Not Poir. 1816.

Panicum microcarpon Muhl. Descr. Gram. 111. June, 1817. Not ex Elliott. Jan. 1817.

Another long familiar name must give place to one of Schultes. Elliott's conception of the *P. microcarpon* of Muhlenberg, as indicated by his description and a specimen from him in the herbarium of Columbia University, was, unfortunately, at variance with that of Muhlenberg himself, so that Elliott's publication of the name, accredited by him to Muhlenberg, invalidated the latter's publicacation of the same name, rightly applied, some five months later. The *P. multiflorum* of Elliott, on account of Poiret's earlier publication, becomes a homonym. That of Schultes, founded on *P. multiflorum* Ell., is apparently the next available.

PANICUM PSEUDANCEPS sp. nov.

Whole plant, with the exceptions noted below, smooth and glabrous. Culms caespitose, 3–7 dm. tall, erect, slender, much compressed, at length branching at each node; nodes 2 or 3; sheaths compressed and keeled, shorter than the elongated internodes, an external tuft of long hairs on each side at the apex; ligule a ring of hairs 2–3 mm. long; leaves narrowly linear, elongated, conduplicate, at least when dry, 1–3 dm. long, 2–4 mm. wide, long-acuminate at the apex, a little narrowed toward the base, somewhat pilose on the upper surface at and near the base, the basal leaves numerous, about one-half as long as the culm, the culm leaves 2 or 3; panicle long-exserted, narrow, 1–2 dm. long, its branches hispidulous, in 1's–3's, slender, erect, somewhat flexuous, the larger 5–9 cm. long; spikelets numerous, 2.5 mm. long, lanceolate when closed, often with 1–3 bristles at the base, on hispidulous pedicels commonly shorter than themselves, appressed, the first, second and third scales membranous, acute, the first and second a little hispidulous on the keel toward the apex, the first scale about two-fifths as long as the spikelet, broadly triangular-ovate, 3-nerved, the second and third scales equal in length, broadly-ovate when spread out, the second 5–7-nerved, the third 5-nerved and enclosing a 2-nerved hyaline palet somewhat shorter than itself, the nerves sparingly ciliate, the fourth scale chartaceous, about three-fourths as long as the spikelets, yellowish, elliptic, about 1.75 mm. long, .7 mm. wide, a little pubescent at the acutish apex, enclosing a palet of equal length and similar texture; anthers purple, about 1 mm. long.

Collected by Mr. J. H. Simpson in Florida in 1889, and distributed as *P. anceps* Michx., from which it is markedly distinct by the slenderer culms and leaves, the narrow panicle with its erect and slender branches, and the spikelets but little more than one-half as large.

✓PANICUM TSUGETORUM sp. nov.

Culms and sheaths pubescent with short appressed hairs intermixed toward the base with longer ones. Culms tufted, 2–4.5 dm. tall, slender, at length much branched and decumbent or prostrate; sheaths shorter than the internodes; ligule a ring of hairs about 1 mm. long; leaves erect or ascending, firm, lanceolate, 5–7-nerved, minutely appressed-pubescent beneath, smooth and glabrous above, or the upper primary leaves sometimes with a few long erect hairs, the primary leaves 4–8 cm. long, 5–8 mm. wide, those on the branches smaller and partly concealing the small panicles; primary panicle broadly ovate, 4–6.5 cm. long, its branches spreading-ascending; spikelets broadly obovate, about 1.8 mm. long, the outer 3 scales membranous, pubescent with short spreading hairs, the first scale broadly ovate, acute, 1-nerved, nearly one-half as long as the spikelet, the second and third scales broadly oval when spread out, 7–9-nerved, the fourth scale chartaceous, oval, about 1.5 mm. long, enclosing a palet of similar texture and equal length.

Type material collected by the writer in the Hemlock Grove, New York Botanical Garden, on dry soil, June 22, 1896, no. 287. The later and much branched condition was secured at the same spot on July 20 and August 20 of the same year, Nos. 417 and 483 respectively.

ARISTIDA LANOSA Muhl., Descr. Gram. 174. June 12, 1817.

Aristida lanata Poir. in Lam. Encycl. Suppl. 1:453. 1810. Not Forsk. 1775.

Chaetaria gossypina Bosc; Beauv. Agrost. 30. 1812. Name only.

Chaetaria gossypina Beauv. R. & S. Syst. 2:391. July 31, 1817.

The date of the copyright of Muhlenberg's work is June 12, while that of the preface of the second volume of Roemer and Schultes' Systema is July 31, both in the same year. Muhlenberg's name, therefore, takes precedence of that of Beauvois. The specific name of *gossypina*, credited to Bosc by Beauvois under the generic name of *Chaetaria*, although occurring in a work published five years previous to that of Muhlenberg, is not available, as no description or synonymy are given by Beauvois, the name being merely cited as a manuscript name of Bosc.

SPOROBOLUS NEALLEYI Vasey, Contr. U. S. Nat. Herb, 3: 61. 1892.

As the description given by Dr. Vasey, at the place above cited, is rather short, and its efficiency being further impaired by the confusion existing in the last lines, owing to the omission of some words, another and more complete description seems desirable. The following is, therefore, appended, drawn from the material to which the writer has had access:

Plant grayish green; culms from a perennial root, densely tufted, smooth and glabrous, erect, slender, 1.5–5 dm. tall, the sterile shoots about one-half as long as the culms; sheaths shorter than the internodes, a ring of long hairs at the apex, the lower sheaths usually more or less villous, at least the uppermost one elongated and glabrous; ligule a ring of long hairs; leaves spreading, rigid, flat, or involute in drying, rough above, smooth beneath, 4–10 cm. long, 1.5 mm. or less wide; panicle at first included, at length exserted, open, 3–8 cm. long, ovate, its smooth branches spreading and slender; spikelets about 2 mm. long, often purplish, on hispidulous pedicels; empty scales narrow and acuminate, the first about one-half as long as the second which is hispidulous on the mid-nerve toward the apex and about four-fifths as long as the acute third; palet acute, about as long as the scale.

During the past summer Mr. E. O. Wooton secured this grass from another locality, it being previously known from Texas only. Mr. Wooton collected it on the White Sands, Doña Ana Co., New Mexico, July 17, 1897. No. 160.

BLEPHARONEURON gen. nov.

A tufted perennial grass with simple culms, long leaves and a terminal loose and open panicle. Spikelets 1-flowered, the rachilla articulated above the empty scales, the pedicels filiform, flexuous, abruptly and much thickened at the apex; scales 3, membranous, the outer 2 empty, 1-nerved, acute, smooth and glabrous, the first narrower and shorter than the second, the third scale equalling or a little longer than the second, entire or minutely 2-toothed at the obtuse apex, 3-nerved, the nerves densely pilose, excepting at the apex, with long ascending silky hairs, the midnerve usually excurrent in a short point; palet as long as but narrower than the scale, acuminate, 2-nerved, densely pilose on and between the nerves, with ascending silky hairs; stamens 3; styles 2, slightly or not at all united at the base; stigmas plumose.

A monotypic genus of Mexico and the southwestern United States, based on the *Vilfa tricholepis* of Torrey. This, in recent years, has been considered a member of the genus *Sporobolus*, but its inclusion therein necessitates the extension of the limits of that genus to such a degree that the result thus obtained neither serves the use of expediency, nor that far more vital and important factor in systematic work, the treatment of genera from the standpoint of natural and evident groups. I would, therefore, propose the above name for this interesting grass, the densely pilose nerves of the flowering scale and palet suggesting it. The plant has not the appearance of a *Sporobolus*, and the densely pilose character of the nerves, above alluded to, abundantly distinguishes it from that genus, which, even from its present conception, appears to contain species too widely separated in essential characters.

BLEPHARONEURON TRICHOLEPIS (Torr.).

Vilfa tricholepis Torr. Pacif. R. R. Rep. 4: 155. 1857.

Sporobolus tricholepis Torr.; Coult. Man. Rocky Mt. Bot. 411. 1885.

✓SPOROBOLUS GIGANTEUS sp. nov.

Plant smooth and glabrous. Culms somewhat tufted, stout, erect from a usually decumbent base, 1–1.5 metres tall, about 1 cm. thick at the base; sheaths crowded and overlapping, striate, loose, villous-ciliate on the margins, a tuft of villous hairs on each side at the summit, the uppermost sheath elongated and enclosing the greater part of the panicle; ligule a ring of very short hairs; leaves erect, 2–5 dm. long, 1 cm. or less wide at the base, attenuated into a long slender point; panicle yellowish white, shining, strict, rigid, 3–5 dm. long, 6–10 mm. thick, the greater portion included in the sheath, its branches appressed; spikelets numerous, 3 mm. long, the scales narrow, acuminate, 1-nerved, the nerves hispidulous toward the apex, the first scale one-half as long as the second which equals or slightly exceeds the third; palet a little shorter than the scale, acute; grain oval, about 1.5 mm. long.

Type collected by Mr. E. O. Wooton on the White Sands, Doña Ana Co., New Mexico, on August 26, 1897. No. 394. Also secured on adobe soil at Mesilla, on June 22, of the same year. No. 582.

Mr. Wooton informs me that the two varieties, *flexuosus* and *strictus* of *S. cryptandrus*, occur on the White Sands with this, the largest species of the genus in the country, and that they appear perfectly distinct, no intergrading forms occurring.

On an abnormal cone in the Douglas Spruce, Pseudotsuga mucronata.

BY FRANCIS E. LLOYD.

(WITH PLATE 327.)

While studying a number of specimens of this species which had grown in a grove at Forest Grove, Oregon, the writer found a tree about 40 years old in which the leader of the year before had produced in its upper portion a cone which was abnormal both in its position and structure.

Normal cones are produced from lateral buds at the ends of twigs in the middle and lower portions of the tree. During the few days while pollination is in progress they stand upright. After pollination, however, they exhibit a downward movement till the position is entirely reversed and the cones hang down, in doing which they have assumed the position characteristic of the spruces, to which the Douglas Spruce is closely allied.

The normal cones are from 7 to 10 cm. in length and when mature and dry the scales spread to make a width of 4 to 4.5 cm. The ovuliferous scales are orbicular in outline, and are concave above. Each scale is subtended by a so-called bract, which is nothing more or less than the leaf which subtends the scale, but which differs from the ordinary foliage leaves in being expanded laterally. The character of the lateral expansion is of great interest,for we have here a structure which strongly suggests a stipular affair. So far as the topography of the bract and the ontogenetic series found in the female shoot offer evidence, it would seem that we are justified in so regarding it. At the base of the cone the lateral expansions are quite small and at the base of the bract. In ascending the cone the blade gets smaller gradually till it becomes at the top a mere point on the tip of the now triangular scale-like bracts which are quite primitive in character. That these expansions are, strictly speaking, stipules may be objected to on the ground that there is not developed therein any vascular tissue, for it has been held that the development of such tissue is a constant feature of stipular outgrowths.* May not the leaves in conifers be regarded as exceptional, however, on account of their peculiarities in the distribution of the vascular tissue, and their manner of growth? If, however, the use of the term stipule entails the idea that the causes underlying the origin of the lateral expansion of the bracts in *Pseudotsuga* and the true stipule of the Angiosperms are the same, we have here a more serious objection and one which cannot be put away without further study. In *Abies* such an expansion of the bracts takes place, and certain features in the cones of this genus and of *Pseudotsuga* indicate that the pressure of the scales upon the bracts may account for it. This explanation is suggested by a consideration of the maturing cones of *Pseudotsuga*. During the growth of the cone after fertilization, the pressure of the scales upon the bracts, which continue to grow at their bases, increases and they become narrower and more constricted wherever this increased pressure is brought to bear upon them. This is, of course, in their lower parts which are not exserted.

As to the function of these bracts it may be said that, while they are undoubtedly assimilative to some degree both before and after anthesis, they serve more especially as guides to lead the pollen to the micropyles during pollination. In this regard, therefore, they are far different from the stipules of angiosperms.

The transverse section of the upper or laminar portion of a bract shows that the bracts conform to the leaves in their plan of structure, but do not develop any supporting cells in the interior. This is correlated with the fact that the bracts do not support themselves in the more or less horizontal position in which the ordinary leaves are placed, but simply hang down. The parenchyma, moreover, consists of spherical cells and there is no well defined palisade tissue nor stellate cells.

A similar section taken through the stipular region shows the same features, and shows in addition the character of the lateral expansion, which consists of a thin extension of the spherical parenchyma cells bounded above and below by the epidermis. The endoderm is here but poorly developed, while in the lamina the sheath is continuous and fairly well formed. The foliage leaves, on the other hand, have a strongly developed hypoderm which is absent only in the regions in which are found the stomata.

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* "The Nature and Origin of Stipules," A. A. Tyler, Ann. N. Y. Acad. Sci., 10: 1–49. 1897.

The abnormal cone, which, as has been stated, was produced in the upper portion of the leader, is 45 mm. long, and is made up of seminiferous scales subtended by slightly modified leaves. The scales in the lower portion of the cone are somewhat irregular but differ only in a minor degree from those in the normal cone, while as we pass upwards they become smaller and somewhat irregular and scattered. That they become scattered is due to the failure of the scales to develop in some cases, although a close examination of the axils of the leaves in these cases will discover small structures of bud-like appearance. That these structures are the morphological equivalents of buds, their origin and position strongly attest. That they would, upon further development, have become ovuliferous scales is equally sure.

There can be no doubt, therefore, that the scales are developed from the axils and not from the upper faces of the leaves. The scale is, therefore, not "an appendage, a ventral excrescence, a ligule if it may be so called, of a leaf,"* but rather a reduced and modified branch. In support of the view, first advanced by A. Braun, that the scale represents two connate leaves, it may be said that the irregularity of the scales, when such irregularity occurs, seems to be due in each case to unequal growth of the two halves. This is what would be likely to happen under a slight irregularity of nutrition. Furthermore, the line of connation can be traced in one case by a ridge along the inside of the scale.

In several of the scales ovules were produced, but these failed of fertilization, and so no seeds were matured.

The scales are subtended by leaves which differ from the normal leaves in having acute apices and in some cases in being slightly expanded in the lateral portions. In the production of these characters, however, a strong attempt has been made to copy in every respect the normal cone in which the leaves are modified in just this way but to a greater degree. The amount of lateral expansion undegone by the various cone-leaves is greatest in the thickest part of the cone, paralleling in this regard the case of the normal cone.

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* Eichler: Monatsber. d. k. Acad. d. Wiss. Berlin, 1881.

Below the base of the cone for the distance of 1 cm. are found foliage leaves with acute apices (Fig. 15). Further still below, the leaves approach more closely to the normal shape (Fig. 14), but still differ in having somewhat acute apices (Fig. 20).

The leader involved is bent so as to suggest that some accident overtook it during its growth. The bracts are quite sharply bent at their tips (Fig. 12), as if they too had shared the leader's misfortune. At the top of the leader were produced normal terminal and lateral buds which developed in the usual way the following spring.

We have, then, in the structure upon which the above description is based the result of the sudden assumption of the sporophyllary function by the tissue of a normally strictly negative shoot. We have here to do with the question which has grown out of Bower's * view that foliage leaves are secondary structures produced by the sterilization of the sphorophylls.

Bower has been followed by Atkinson,† who has attacked the problem from the point of view of the experimental morphologist, and has discussed the relation of the sporophyte to nutrition. Professor Atkinson's convictions in the matter are based to a considerable extent upon experimental work upon two species of *Onoclea*, in which the sporogenous leaves were made to take on the assimilative condition by cutting away the earlier and normally assimilative leaves and thus robbing the plants of food which they would otherwise get. The condition thus induced is compared directly with the probable conditions under which the sporophyte was made to assume more and more the assimilative function when the change from water to dry land was one with which the gametophyte was unable to cope.

The conversion of a vegetative shoot in a conifer to a sporophyll-bearing shoot is of peculiar interest in this connection in that it must have some bearing upon the view propounded by Bower. In the coniferae only a few lateral buds are normally produced near the ends of the vegetative shoots. In the pistillate shoots, however, the axillary buds, throughout the greater part of its length, are developed into the ovuliferous scales. The production of these scales, therefore, upon a shoot normally vegetative would seem to be due to excess of nutrition, in response to some sort of irritation. Why the axillary buds thus forced into growth should not become simply vegetative, instead of spore-bearing, may be due to inherited tendencies, and if so, we have here a case of atavism, a return to a condition during times long gone by, when the sporophyte was chiefly or altogether sporogenous. Unfortunately for this view, there is no little difficulty to be encountered in harmonizing the facts derived from the study of teratological conditions found in the angiosperms, as, for example, the change from carpel to foliage leaf. All that we can assert at present is the interchangeable character of plant structures.

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* Bower: "A Theory of the Strobilus in Archegoniate Plants." Ann. Bot., 8 343. 1894.

†Atkinson: Woods Holl Biol. Lect. 1895. Am. Nat. 30: My. 1896.

Explanation of Plate 327.

Figs. 1–11 inclusive. A series of bracts from the pistillate shoot.

Fig. 1. Leaf from pistillate shoot immediately below the cone.

Fig. 2. Bract from base of cone.

Fig. 11. Bract from tip of cone.

Fig. 12. Lateral view of the apex of a bract from the abnormal cone.

Fig. 13. Normal leaf, × 3/2.

Fig. 14. Leaf from the leader which produced the abnormal cone.

Fig. 15. Leaf taken from the leader immediately below the abnormal cone.

Fig. 16. Leaf subtending a scale in the abnormal cone showing the maximum degree of lateral expansion attained.

Fig. 17. A small portion of the leader bearing a leaf and, in its axil, a reduced scale, × 15/1, *s*, scale; *l*, leaf; *c*, leaf-cushion.

Fig. 18. Longitudinal section of same, × 20/1 about. Drawn with camera lucida.

Fig. 19. Tip of normal leaf, × 6/1.

Fig. 20. Tip of leaf from leader in question, × 6/1.

Fig. 21. An abnormal, asymmetrically developed scale showing discrepancy of growth between the two sides, × 3/2.

Porella once more.

I. BY AUGUSTE LE JOLIS.

Mr. Marshall A. Howe, having been so courteous as to send me a copy of his recent paper on "The North American Species of Porella," reprinted from the BULLETIN OF THE TORREY BOTANICAL CLUB, November, 1897, in which I am somewhat criticised, I beg leave to present a brief reply in the same BULLETIN.

In his paper, Mr. Marshall A. Howe concludes, from the identification of the specimen in the Dillenian herbarium, that the name *Porella* must "stand as the name of the genus." I cannot agree with such a deduction. If, owing to that identification, the *specific* question has long ago been resolved, the *generic* question is quite another thing, and it stands thus: Is the Dillenian lycopodiaceous genus *Porella* a previous equivalent to the modern genus *Madotheca?* Is its generic character the true generic character of *Madotheca?* That is the question.

Dillen has established his genus on "naked antheraceous capsules, without operculum or pedicel, dehiscing by several pores through the sides, and emitting a farinaceous powder," whence the name *Porella*. Consequently, any plant which does not bear such capsules, with several farinaceous pores, cannot be entered in the genus *Porella* nor can be entitled to bear that significant name *Porella*.

It is to be considered that Dillen, after ranging his *Porella* among the lycopods, describes and figures *another specimen of the same species* in his genus "Lichenastrum" (=*Jungermannia*), under the name "Lichenastrum filicinum pennatum" (Hist. Musc., 495. *pl. 71. f. 25*), the specimen of which, in the Dillenian herbarium, according to the opinion of S. O. Lindberg and Prof. S. H. Vines, certainly belongs to the same species as the specimen of "Porella pinnata." In fact, *Porella* was a mere blunder of Dillen, and a name which is the expression of such a gross blunder cannot stand as the name of a modern scientific genus.

I may add that Mr. Marshall A. Howe seems to have somewhat misunderstood my papers on *Porella*, for I have never written "that Dickson considered his *Jungermannia Porella* to be different from the *Porella* of Dillenius"; on the contrary, I have said that Dickson, having compared his *Jungermannia* with the specimen of Dillen, did find out that the two plants were alike.

I may also give notice that my own copy of "Dillenii Historia Muscorum" is the editio princeps of 1741, and that I have not seen the reprints of 1763 and 1811, to which Mr. Marshall A. Howe has only had access; I am then ignorant if those reprints or reproductions of the plates are quite identical with the standard original edition.

As to the expression "Porella pinnata L.," it seems most unreasonable thus to point out Linné as the author of the genus and species, when he himself declares that he has never seen the plant, gives no description of it, and quotes only the Dillenian name, affixing to it the sign †, meaning that the plant is thoroughly unknown to him.

CHERBOURG, January 9, 1898.

II. BY MARSHALL A. HOWE.

While the author of the paper which M. Auguste Le Jolis has honored with the foregoing comments believes that the chief end of botanical science is the study of plants rather than of plant-names, a sentiment which his well known critic would heartily endorse, he nevertheless cannot well wholly evade the puzzles of nomenclature and is obliged to admit that their correct solution is a matter of considerable importance. In regard to the principal point referred to by M. Le Jolis—the question of equivalence of *Porella* and *Madotheca*—the only inquiry that needs to be made by one who follows the code adopted at Rochester in 1892 by the Botanical Club of the American Association for the Advancement of Science is whether the species to which these names were originally applied are congeneric. That these species are thus congeneric has, I think, been sufficiently demonstrated, and seems not now to be contested even by M. Le Jolis. The French savant's chief objections to the use of the name *Porella* are in accord with the sentiments of the Paris Code of 1867, which is accepted by the great majority of American systematic botanists of to-day only with certain modifications. The practical application of the Paris code, with its provisions for various exceptions to the law of priority, led to such diversities of usage in matters of nomenclature, especially, perhaps, in the Phanerogamia, that working systematists in various parts of the world have thought to secure greater stability of nomenclature in the end by closer adherence to the priority principle, even though this principle is not so easy to apply as to formulate and unfortunately calls for the disappearance of many familiar names. Practically the sole limitation imposed on priority by the Rochester code is the initial date 1753. Three of the articles of this code are:

I. *The Law of Priority*—Priority of publication is to be regarded as the fundamental principle of botanical nomenclature.

II. *Beginning of Botanical Nomenclature.*—The botanical nomenclature of both genera and species is to begin with the publication of the first edition of Linnaeus' "Species Plantarum," in 1753.

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V. *Publication of Genera.*—Publication of a genus consists only (1) In the distribution of a printed description of the genus named; (2) In the publication of the name of the genus and the citation of one or more previously published species as examples or types of the genus, with or without diagnosis.

In accordance with the spirit of the second part of Article V., I would, therefore, with Lindberg, Spruce, Carrington, Pearson, Mitten, Arnell, Underwood, Evans, Kaalaas, Rossetti, and others, (at times, also, Stephani, Massalongo and Schiffner), take the ground that *Porella* is not a *nomen nudum* with Linnaeus. It is true that he never saw the plant, but he did give it a place among his genera and species, and referred to the figure and description given by Dillenius, and this saves the *Porella* of Linnaeus from being a "bare name."

It is incontestable that Dillenius made serious errors in his interpretation of the characters of the plant and that these are embalmed in the name *Porella*. Yet the meaning of his description and figures was sufficiently clear to give Dickson (on receiving what was perhaps the first specimen of the plant thereafter sent from America to Europe) ground to "suspect" that his plant and that of Dillenius were "the same"—which he easily proved to be the case by comparing the specimens. And it seems to me that his figures and description were sufficiently clear to have enabled others besides

Dickson to "suspect." But "*Porella*" was from America. If it had been attributed to Europe (where, also, *Porella pinnata* is said to occur) the botanists of the time would, it may be, have been more curious to know what the genus which the distinguished Linnaeus had thought worthy of being copied into his works really was; would, perhaps, after Dickson's identification and corrections, have written it as a synonym of *Jungermania*, and, possibly, on the final dismemberment of the latter group, would have assigned it its proper place with the necessary emendations. But "priority" was not so much in vogue in those days, though, in general, there was great respect for the Linnaean names. As it was, however, Nees (in Naturgesch. Eur. Leberm.) recognized "Porella Dill." as a synonym of his *Madotheca Porella.*

"*Madotheca,*" itself, in its original form, has little to boast of over *Porella.* Dumortier, in his Commentationes Botanicae (1822, p. 111), writes:

MADOTHECA

Colesula ore coarctato; theca quadridentata; elaters vagi circumdati.

Platiphylla   Laevigata
Thuya

*Not an essential character of the "genus" is touched upon,** and

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* Greatly superior to this is S. F. Gray's diagnosis of the equivalent *Cavendishia* published one year earlier (Nat. Arr. Brit. Pl. 1: 689. 1821). It reads as follows:

"XVIII. 332. CAVENDISHIA. *Cavendish.*

"Monoicous. MALE. *Anthers* spherical, pedicelled, solitary, in the axillae of the perichaetial leaves. FEM. *Calyx* lateral, ovate, narrow at bottom, compressed, becoming cylindrical; mouth truncated, serrate, slit on one side; *peduncle* short, not jointed; *capsule* spherical, seemingly 4-valved; valves upright, irregularly networked; *seed* roundish; elaters membranaceous, tubular; helices double, loosely twisted; *leaves* 2-rowed, 2-cut, segments unequal, conduplicate.

"1. *Cavendishia platyphylla.* *Broad-leaved cavendish.*

"*Stem* lying down, bipinnately branched; *leaves*, upper lobe roundish, ovate, scarcely cut; lower lobe and *stipules* strap-like, uncut.

"*Lichenastrum arboris vitae facie, foliis minus rotundis*, Dillen Musc. 72, 32.

"*Jungermannia platyphylla*, Lin. S. P. 1600; Eng. Bot. 798; Hooker Jung. 40.

"*Jungermannia cupressiformis β*, Lamarck Encyl. 3, 383."

[Two varieties, *β major* and *γ thujaeformis*, are also described, and the habitat given.]

"2. *Cavendishia laevigata.* *Smooth cavendish.*

"*Stem* lying down; branches irregularly pinnate; *leaves* 2-rowed, unequally 2-

the identity of the group is recognizable only by the familiar form of the three specific names that he mentions.* He does not even state where these names may be found in the works of his predecessors. Moreover, "Madotheca" is placed in his Tribe I., the Lejeuniaceae, the members of which have the following character: "Theca pellucida univalvis quadridentata." But the "theca" of his *Madotheca* is no more pellucid than in some members of his Tribe II. (Jungermanniaceae), in which this organ is said to be coriaceous, the theca is not *univalved*, and it is not quadridentate in any modern sense of the term. It is true that Dumortier improved considerably upon this diagnosis nine years later, yet the name owes its worth chiefly to the emendations of Nees von Esenbeck; and *Porella*, it must be confessed, owes very much to the emendations of S. O. Lindberg.

It cannot be disputed that the name *Porella* was given through a wrong understanding of some of the characters of the plant. Yet if generic or specific names are to be rejected simply because they are inappropriate or embody misconceptions, where are we to stop? Under this method of procedure, every writer may consult his own tastes and caprices as to the aptness of a name, as the past history of taxonomy has abundantly demonstrated. Commonly used and "classical" generic names † that were founded on wrong ideas or that are false and misleading except

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lobed, thorny-toothed; upper lobes largest, rounded ovate, lower strap-shape, flat pressed close; *stipules* oblong, 4-sided, thorny-toothed.

"*Jungermannia laevigata* Schrad. Samml. 2, 6; Hooker Jung. 35.

"On the ground in mountain woods."

If this hepaticological work of S. F. Gray was mere compilation, as has been alleged, it was a much more intelligible compilation, on the whole, than that of Dumortier in his Commentationes Botanicae. About the only part of the above description that can be considered positively wrong is the attributing of a monoicous character to the genus, while both the species on which it is based are now uniformly described by systematists as dioicous. Yet a modern morphological investigator writes: "Les Madotheca sont monoïques, on trouve les deux espèces d'organes de reproduction dans la même inflorescence (Fig. 52, Pl. IX.)!" [L.-A. Gayet, L' Archegone chez les Muscinées, Ann. Sci. Nat. Bot. VIII. 3: 199. 1897.]

BELLINCINIA and ANTOIRIA of Raddi are also older than *Madotheca* and no one doubts their meaning.

* See remarks of Richard Spruce on Dumortier's genera. [On Cephalozia, 1.]

† EULOPHUS Nutt. (*ευ*, *well*, and *λόφος*, *a crest*) "is not well applied," says Asa Gray, "to a plant with no crest at all." Yet the name appears in De Candolle's

for the original species are not far to seek and from these we may pass to any shade of inappropriateness.

The identity of the species to which Linnaeus applied the binomial *Porella pinnata*, without ever seeing it himself, will, I think, hardly be called in question, and knowing the species we also know its genus, even though the generic diagnosis can never be completed and properly restricted until all the species of the group in the world are accurately known. Knowing the single species to which the generic name *Porella* was applied by Dillenius (copied by Linnaeus), and knowing, too, by tradition or otherwise, the three species to which Dumortier in 1822 (with an unmeaning 8-word diagnosis) applied the generic name *Madotheca*, we are agreed that the four species are congeneric. Our main point of difference, then, is over the question whether the Dillenian and Linnaean name, which has claimed a goodly number of partisans in recent years, shall stand, or the name introduced by Dumortier some seventy or eighty years later—a question concerning which men equally honest, equally thorough-going and equally "scientific," may doubtless differ. Personally, believing that a rigorous application of the priority principle gives promise of the best final solution of our nomenclatural difficulties, I cannot do otherwise than to adhere to the name *Porella*.

If Dillenius had *Porella pinnata* also under "Lichenastrum filicinum pennatum" on a later page of the Historia, as seems well attested, this fact would have no special bearing on the point at issue, for "Lichenastrum" does not appear as a genus on the pages of Linnaeus; and Linnaeus, not Dillenius, is our starting

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Prodromus and is generally used.

GALAX L. "Name from *γαλα*, *milk*, of no conceivable application to the plant" [Asa Gray]. Yet it is adopted in Engler and Prantl, Nat. Pfl. Fam., and is in general use; and the only known species is *Galax aphylla* L., of which Linnaeus never wrote *one word* of his own in the way of *specific* description. Moreover, the *leaves* of *Galax aphylla* are the most conspicuous part of the plant. In this case we have a specific name that is positively *false* ("a mere blunder" of Linnaeus!), a generic name that is certainly misleading, and a species which Linnaeus never formally defined, yet "Galax aphylla L." is maintained by every one!

CHAMAELIRIUM Willd. (Name from *χαμαι*, *on the ground*, and *λειριον*, *lily*.) Plant 1½–4 feet tall. "Genus founded on a dwarf undeveloped specimen." In Engler and Prantl, Nat. Pfl. Fam., and generally used.

This list of more or less grossly inappropriate names might be widely extended.

point, even though we are often obliged to go back of Linnaeus for the proper understanding of his genera and species. The "Lichenastrum filicinum pennatum" is said to have come from Patagonia, one quarter of the earth's circumference from Pennsylvania, the habitat of *Porella pinnata*, and if Dillenius classified it under quite a different head it is perhaps only additional proof that the illustrious cryptogamist shared with other mortals the liability to err.

M. Le Jolis says that, "As to the expression '*Porella pinnata L.*' it seems most unreasonable thus to point out Linné as the author of the genus and species when he himself declares that he has never seen the plant, gives no description of it and quotes only the Dillenian name," etc. Yet hepaticologists, almost without exception, now write "*Targionia hypophylla L.*," to which Linnaeus, so far as I am able to discover, never gave *one word* of his own in the way of *specific description*. But *Targionia hypophylla L.* cannot fairly be called a *nomen nudum*, for he made his meaning clear by citing descriptions and figures in Micheli and other authors who were more familiar with the plant than he. Writing "*Targionia hypophylla L.*," then, simply signifies that Linnaeus was the first to combine the specific name *hypophylla* with Micheli's generic name *Targionia*. So, writing "*Porella pinnata L.*" means simply that Linneaus was the first to combine the specific name *pinnata* with Dillen's generic name *Porella*. It would certainly be most unreasonable and unjust, in a formal systematic work, to write "Targionia L." over a generic diagnosis without accompanying it by "Ex Michelio," inasmuch as Micheli was its real author; under the same circumstances, *Porella* should be followed by "L. Ex Dill." as I have written it in the paper to which M. Le Jolis refers. But that the day may sometime come when there shall be sufficient uniformity in plant nomenclature to justify the dropping of the name of the author entirely in all ordinary use is a thing to be hoped for.

M. Le Jolis is to be congratulated on his possession of the "editio princeps" of the Historia Muscorum. We imagine, however, that the essential points in the controversy are covered equally well by the Edinburgh reprint of 1811, together with the abridged edition of 1763.

M. Auguste Le Jolis says: "I may add that Mr. Marshall A. Howe seems to have somewhat misunderstood my papers on *Porella*, for I have never written 'that Dickson considered his *Jungermannia Porella* to be different from the *Porella* of Dillenius'; on the contrary, I have said that Dickson, having compared his *Jungermannia* with the specimen of Dillen, did find out that the two plants were alike." M. Auguste Le Jolis would have given a somewhat more accurate idea of what I really wrote if his quotation marks had been a little more widely inclusive. My statement was:* "Mr. James Dickson was the first to detect that the *Porella* of Dillenius belonged to the Jungermaniaceae, and it may be worth while to quote his narrative of the circumstances, especially as M. Le Jolis has somewhat recently† given the impression that the discovery was wholly a chance affair and also that Dickson considered his *Jungermannia Porella* to be different from the *Porella* of Dillenius." The last half of this "impression" of mine was derived from the following words of M. Le Jolis:‡ "Il [Dickson] donne ensuite une description et une figure de cette espèce, *la considérant avec raison comme nouvelle* § et en souvenir du nom de Dillenius la nomme *Jungermannia Porella*." If M. Le Jolis meant by "nouvelle" simply that the species had not hitherto been entered in the genus *Jungermania* we owe him an apology. He should be allowed the privilege of interpreting his own words. It is true that in the preceding lines (*l. c.*) he had stated that Dickson "reconnut que les deux plantes étaient semblables." But "semblable" seems to a foreigner to have a slightly dubious meaning, especially in connection with such words as cited above, and, I suspect, does not exhaust the possibilities of the French language for expressing Dickson's complete conviction as to the specific identity of the two specimens.

Mr. Dickson himself says on this point: "Upon the most careful examination, I found my *Jungermannia* to agree exactly with his *Porella*, but could find no fructification upon his specimen. As I have no doubt that my *Jungermannia* and his *Porella* are one and the same plant, I shall next endeavor to trace how Dillenius has fallen into this error." Dickson's identification has been repeated by competent critics several times since, and one might go so far as to infer from his latest statements that even M. Auguste Le Jolis no longer entertains doubts as to what *Porella* really was, but perhaps I misunderstand him.

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* Bull. Torr. Bot. Club, 24: 513. 1897.

† Rev. Bryol. 19: 99. 1892.

‡ Rev. Bryol. 19: 99, line 33. 1892.

§ The italics are ours.

M. Le Jolis has often in his various papers on the nomenclature of the Hepaticae referred with becoming deference to the opinions of one of the great masters of hepaticology—Dr. Richard Spruce. Below, however, are words of Dr. Spruce (relative to the use of S. F. Gray's generic names) which, so far as I know, have never been quoted by M. Le Jolis: "The dogma of the absolute sanctity of the earliest generic or specific name is a comparatively modern invention. That it is, generally speaking, worthy of adoption there can be no doubt, not so much as an act of justice or courtesy to authors as for the sake of settling the synonymy, and out of a multitude of names to have some certain guide to the selection of the only one needed. But if it were claimed solely as a *right* of authors, it might safely be asked if there were no *duties* the fulfillment of which should entitle an author—or his successors for him—to prefer that claim. That there are such duties is so plain that I need not stay to point them out. *For the present, however, it seems that, whether the duties have been fulfilled or not, the right of preference of the most ancient name is the absolute rule of botanists.*" *

COLUMBIA UNIVERSITY, NEW YORK, January 26, 1898.

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* Rev. Bryol. 8: 90. 1881. The italics of the last sentence are ours.

Two new Grasses from Van Cortlandt Park, New York City.

By Eugene P. Bicknell.

(Plates 328, 329.)

Savastana Nashii.

Perennial from slender creeping rootstocks; culm simple, erect, 6–10 dm. tall, smooth and glabrous; sheaths smooth and glabrous, closely embracing the culms, all, or all but the upper one, arising from near the base of the culm, elongated, the upper one sometimes 30 cm. long, much overlapping, the exposed interspaces 5–15 cm. in length; principal leaves 5–8, ascending or erect, narrowly linear from a narrowed base, tapering to an attenuate apex, 3–5 mm. wide, 1–3 dm. long, much longer than the interspaces, the penultimate leaf usually longest, those below gradually shorter, one or more basal ones abruptly much reduced and nearly bladeless; lower surface of the leaf-blades bright shining green, upper surface dull green and glabrous or with some obscure pubescence, the rough edges scarcely involute when dry except at the scabrous apex; lower leaves at flowering-time becoming dry and narrowly involute; ligule from 2 mm. long on the lower leaves to 7 mm. long on the uppermost, the margins becoming ciliate, pubescent; panicle slenderly long-exserted, very loose and open-often one-sided, 1.3–4.8 dm. long, the very delicate hairlike branches simple or remotely short-branched, 8–23 cm. long, in about four distant main pairs below the drooping top of the panicle, the lower pairs 5–8 cm. apart, all loosely spreading or ascending and bearing the spikelets above the middle in delicate moniliform pendulous sprays; spikelets 5–8 mm. long, 1.6–3 mm. wide; lower glumes somewhat unequal, the inner surpassing the outer 1–1.5 mm., delicately membranous and silvery hyaline, 3-nerved, the outer nerves often nearly obsolete on the narrower first glume, the second glume 3 mm. wide, tapering from about the middle to an attenuate apex; flowering-glumes about 5 mm. long, narrower and more gradually acuminate than in *S. odorata*, 5-nerved, chartaceous, chestnut-brown, often obscurely puberulent-roughened, minutely awned from the acuminate bifid apex; palets cleft at the apex into slender teeth; fertile flower hairy-pubescent at the top of the minutely awned outer scale; each flower with a minute tuft of hairs at its base; sterile culms similar to those of *S. odorata* but taller, its more numerous leaves longer and more acuminate. (Plate 328.)

Discovered in Van Cortlandt Park, New York City, July 11, 1897, freshly in flower and growing plentifully about the weedy border of an alder thicket close to a brackish marsh. Near by was an abundant growth of *Savastana odorata*, its remaining fertile culms having the leaves and panicle dried and brown. *S. Nashii* was still in flower at the same spot on August 8th and withering specimens were collected September 18th.

This grass, although closely related to *Savastana odorata* (L.) Scribn., differs conspicuously in various characters and presents a widely different appearance. Its fertile culms are much taller with more numerous and very much longer leaves, which are narrower, especially at the throat, and with closer sheaths, while the panicle is larger and incomparably looser. The spikelets are narrower and slightly longer, their very delicately membranous outer glumes more unequal, less distinctly nerved, narrower and more gradually acuminate with their tips mostly straight at maturity instead of often outcurved as in *S. odorata;* the flowering glumes are narrower and more acuminate and often more distinctly awned and ciliate.

Not the least noteworthy thing in regard to this grass as compared with *S. odorata*, is its much later flowering period—July to September; *S. odorata*, the earliest flowering of our native grasses, blooming from the middle of April till June.

I take pleasure in naming this interesting grass for Mr. George V. Nash, with whom I was enabled to make a study of it in the field a few days after its first discovery.

CHAETOCHLOA VERSICOLOR.

Perennial from an intricately short-branched and somewhat stoloniferous rootstock; not at all or but slightly tufted; culm 6–12 dm. high, ascending or suberect from an assurgent base, slender, often somewhat zigzag below, simple or bearing a few ascending branches; leaves long and narrow, 1–3.5 dm. long, 2–6 mm. wide, narrowed toward the base, slenderly long-attenuate at the apex, pale green or glaucescent, becoming much colored with purple, smooth, or slightly roughened on both surfaces toward the scabrous apex, the margins minutely serrulate-scabrous except towards the very smooth base which is often finely canescent in the throat but never pilose; ligule a very short, dense fringe of scarious hairs; sheaths very smooth and glabrous, compressed and keeled, the lower mostly longer than the internodes, the upper ones shorter; nodes dark; basal internodes often less than 3 cm. long, those above gradually longer, the upper ones often 1–1.8 dm. in length; peduncles very slender, exserted 1.5–3.5 dm., slightly roughened towards the top and finely pubescent just below the spike; spike rather slender, even slightly flexuous, 2.5–7 cm. long, about 5 mm. thick or across the bristles 1.5 cm., simple, the rachis and pedicels of the spikelets finely hispidulous-pubescent; spikelets single or rarely two together, on pedicels 0.5 mm. long, about 2.5 mm. long, and 1.25 mm. wide; first scale ovate, acute or obtuse, 3-nerved, about one-half the length of the flower; second scale acute, 3-nerved or imperfectly 5-nerved, two-thirds to three-fourths the length of the subequal third and fourth scales; third scale 5-nerved, ovate-oblong, incurved-apiculate; fourth scale ovate-oblong, rather pointed, boat-shaped, the depth slightly more than half the width, the dorsal curve gradually descending, often with a slight concavity, into the somewhat beak-like incurved-apiculate apex, finely transversely rugulose, and obscurely 3-nerved, at maturity deep purple, at least toward the end, giving the spikes a squarrulose appearance; bristles in two nearly united clusters of mostly 5 bristles each, very slender, 6–10 mm. long, ascending or spreading, pale yellowish-green or sometimes purplish. (Plate 329.)

Plants that have been cut early in the season later become closely fastigiate-branched from the base, and bear shorter and thicker spikes and more purplish bristles.

Borders of salt and brackish marshes Van Cortlandt Park and Kingsbridge, New York City; Green's Farms, Connecticut, on Long Island Sound; also in Florida.

From the manner of its occurrence at New York and in Connecticut this grass has every appearance of being a common coastwise species. That it has hitherto been overlooked is to be explained through its similarity to *C. viridis* and *C. glauca*. With the former it is not closely related and need not be critically compared. Its affinity with *C. glauca* is much closer, yet it is perfectly distinct. It differs from *C. glauca* mainly in its perennial instead of annual underground system, more slender culms, much narrower and paler leaves, never pilose at the base, more slenderly peduncled spike, which is narrower and less densely flowered, the spikelets smaller, especially narrower and less gibbous, the scales somewhat different in relative length and venation, the glume of the perfect flower much less convex and rugose and becoming deep purple, the bristles longer and weaker and. never tawny-orange as in *C. glauca*.

Chaetochloa versicolor finds its nearest relative in the following imperfectly known species of the Southern States:

CHAETOCHLOA PERENNIS (Curtiss).

C. glauca var. *perennis* Curtiss in Beal's Grasses of North America, 2: 156. 1896.

This grass, although very near to *C. versicolor*, differs in some noteworthy characters. It is even paler and more glaucous and grows in dense erect tufts, the culms closely branched from the base; the lower sheaths are more broadly flattened, the leaves broader and less attenuate and provided towards the base with long white hairs arising singly from scattered papillae; the ligule is sometimes scarcely fringed; the spikes are often longer, the spikelets at full maturity broader and less pointed, oblong or obovate-oblong and obtuse, the first and second scales shorter, broader and more obtuse, the second one 5–7-nerved instead of mostly 3-nerved, the glume of the perfect flower finely rugulose and remaining green at maturity or sometimes merely tipped with purple. The shorter first and second scales, as compared with *C. versicolor*, seem to be perfectly constant; the first scale is about one-third the length of the spikelet, the second scale one-half its length; in *C. versicolor* the respective scales are one-half and two-thirds or three-quarters the length of the spikelet.

Mr. George V. Nash, who has endeavored to ascertain whether this apparently common grass has not had some previous history, points out to me that it is apparently the same as Muhlenberg's *Panicum laevigatum* in Elliott's Bot. S. C. and Ga. 1: 112. 1817; Muhlenberg's name is preoccupied, however, by *Panicum laevigatum* of Lamarck (Fl. France, 3: 578. 1778). In the herbarium of Columbia University is a sheet from the Torrey Herbarium holding a flowering specimen of a *Chaetochloa* labeled *Panicum laevigatum* apparently in Elliott's handwriting and bearing his name in a corner of the label. This, if not part of Elliott's type, at least may be taken to be authentic material and, though very young, is certainly to be referred to the plant here raised to specific rank. Another sheet from Chapman's herbarium bearing imperfect specimens of apparently the same thing is labeled *Setaria glauca*, var. *laevigata*, coast of Florida. Still other specimens are labeled *Setaria flava* Kunth, a grass unknown to me, but which Mr. Nash assures me is quite a different South American species.

Fabroleskea, a new Genus of Mosses.*

BY G. N. BEST.

Small plants in intricate spreading, pale to dark green tufts. Stems undulate creeping, irregularly divided and sparingly branched; stem leaves spreading-recurved, ovate-lanceolate, narrowly acuminate; costa thin, narrow, disappearing above the middle; leaf cells stoutly unipapillate on both surfaces; capsule erect, symmetric; pseudannulus of seven rows of oblong-oval, compressed, yellowish cells; peristome of sixteen yellowish lanceolate obtuse teeth, deeply inserted and densely covered with stiped papillae; dorsal line faint; ventral face scarcely lamellate; endostome a narrow band without segments or cilia; operculum short conic; calyptra tubular (?).

One species.

FABROLESKEA AUSTINI (Sulliv.) Best.

Leskea Austini Sulliv. Icon. Musc. 81. *pl. 61.* 1874.

Stems 2–3 cm. long, attached to substratum here and there by tufts of yellowish rhizoids; stem leaves concave, entire or sinuate-serrulate above, .7–1.2 mm. long, 3.5–.5 wide; leaf cells in rows, somewhat oblique, thick-walled, nearly uniform, basal and alar broadly oval to oval-quadrate; median elliptical-rhombic to rhomboidal-fusiform, .009–.011 mm. wide, .013–.016 long; apical linear-rhomboidal, monoicous; perichetial bracts oblong-lanceolate, slenderly acuminate, scarcely costate, margins sinuate-dentate.; pedicels erect, smooth, yellow-red, twisted above to the right when dry, 7–9 mm. long; capsule narrow-mouthed, brownish, oval-oblong, 1.5 mm. long, 0.6 wide, with 4–6 stomata at its base; pseudannulus separating between the second and third rows of cells from above; teeth .185 mm. long, .035 wide, confluent at base; endostome yellow, papillate, of 4 rows of oblong-rectangular cells .055 mm. broad; exothecial cell multiform, walls more or less curved, seldom straight; spores minutely roughened, .019–.026 mm.

Matures in late winter and early spring on trunks, rocks and limestone fences.

Widely distributed, yet local and variable. Illinois (Wolf);

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* Based on specimens in the herbarium of Columbia University.

Minnesota (Holzinger); New York (Austin); New Jersey (Austin); Pennsylvania (Rau, Wolle) and South Carolina (Ravenel).

Type locality, Illinois.

EXSIC. Aust. Musc. Appalach. 267.

ILLUST. Sulliv. Icon. Musc. Supp. *pl. 61.* 1874.

REMARKS. Gemmae, more or less abundant, often in clusters, are present in most specimens. Fruiting plants collected by Mr. Holzinger at Winona, Minn., have the leaves somewhat smaller and the peristome less densely papillate. On some of the older deoperculate capsules the teeth are whitish and nearly destitute of papillae, as if these were deciduous as the result of prolonged exposure.

The gametophyte characters of *Fabroleskea Austini* indicate that it belongs to the Leskeaceae, while the sporophytes point to the Fabroniaceae, differing, however, from the latter by its papillate peristome, which resembles very closely those of certain species of *Orthotrichum.* Sullivant* remarks that "the generic position of this species is still uncertain, related as it is by some of its characters to *Leskea*, by others to *Habrodon.*" Lesquereux and James† make the same observation.

The pseudannulus of *Fabroleskea Austini* is analagous to the cells about the mouth of *Fabronia pusilla*, but is much better developed and more distinct, yet not so well as in either *Habrodon* or *Clasmatodon.* The loose exothecial cells are almost identical with those of *Habrodon perpusillus.* It is, therefore, perhaps advisable, in the present state of our knowledge, to refer it as an outlying genus of the Fabroniaceae.

ROSEMONT, N. J.

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* Icon. Musc. Supp., 81. 1874.

† Man. of N. A. Mosses, 303. 1884.

The Mycorhizae of Aplectrum.*

D. T. MacDougal.

In April, 1876, Mr. H. Gilman collected a specimen of *Aplectrum spicatum* near Detroit, Mich., which he described in the Bulletin of the Torrey Botanical Club, 6 : 94. 1876, as being furnished with coralloid roots, and as parasitic on the roots of trees. The specimens was sent to Dr. Gray, who informed Mr. Gilman that such formations were "indeed unexpected," and the matter rested.

I have recently rediscovered this formation on a clump of plants near Lake Minnetonka, and my preliminary examination reveals much of interest concerning this variation in form, as well as some important facts concerning the general biology of the typical plant.

The normal plant of *Aplectrum* consists of a small compressed globose corm bearing a single flower stalk in May, and a leaf arising in August persistent throughout the winter. The corm gives off one or two lateral offshoots, upon the ends of which daughter corms arise, repeating the history of the parent corm.

The plant lives in humus, and it appears that it must be considered a hemi-saprophyte, both from anatomical and experimental evidence, although work upon this point is not complete.

The short straight unbranched roots are from ten to sixteen in number, and arise from the lower part of the corm. These organs entertain two fungi in such manner as to form an ectotropic and an endotropic mycorhiza. The endotropic fungus forms masses of hyphae nearly filling the greater number of the cortical cells of the root, and sending single filaments out through the root hairs into the humus soil. The nuclei of the cortical cells containing the fungus are very large and hyperchromatic, and it is evident that the fungus is beneficial to the tissue inhabited by it. Its general arrangement resembles that of the underground stems of *Corallorhiza*.

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*Preliminary notice read before the Indiana Academy of Science, December 30, 1897.

The brown hyphae from the mycorhiza of neighboring trees adhere and penetrate the epidermis of the roots in patches in such manner as to make it appear that the *Aplectrum* is parasitic upon the trees as suggested by Mr. Gilman. I find, however, that the fungus simply adheres to the roots of both plants and that the *Aplectrum* is parasitic upon the tree only in the remote sense that it is a competitor for the organic substances absorbed by the fungal symbiont from the soil. This last named fungus forms complete coatings on the roots of oaks and maples and penetrates the soil in every direction, adhering to the roots of *Aplectrum* when these are met.

The variation in the species, which forms the chief interest of this paper, is due to the manner in which the endotropic fungus is transmitted from the parent to young plants through the offshoots.

The offshoot is usually a cylindrical smooth stem 1–2 cm. in length, consisting of about three internodes. The cortical cells in normal plants are seen to be filled with the hyphal masses increasing in number from the apical end of the offshoot toward the younger plant. Since no trichomes are present, the hyphae do not pass outwardly and into the soil. An examination near the base of the offshoot on the lower side reveals a small clump of hairs which are directed downward and toward the roots of the parent plant. The fungus in these roots sends hyphae out into the soil, which, meeting the clump of hairs on the offshoot, penetrate through them into the cortical tissues, thence penetrating the offshoot lengthwise to the apex, passing into the roots of the young plant directly, since these organs arise from the apex of the offshoot. By this arrangement the fungus is confined to the absorbing organs and does not gain access to the storage tissues of the corm.

Now, it is to some disturbance in the relations of the fungus in transit through the offshoot that the coralloid formations are due. In such instance the offshoot develops numerous branches consisting of a relatively large number of internodes. The epidermis has developed an enormous number of trichomes resembling root hairs. The fungus sends hyphae out through these hairs and it is to be seen that the offshoot has been converted into an absorbing organ quite similar in structure and appearance to the underground stems of *Corallorhiza*. Other anatomical indications of the change in function are to be found.

It is, of course, readily apparent that, if these structural relations are transmissible, we have here a method by which *Aplectrum* may easily pass from a hemi-saprophyte into a complete dependence upon organic food with loss of chlorophyl. The writer will report further upon various anatomical and ecological features of the plant as soon as experiments now in progress are completed.

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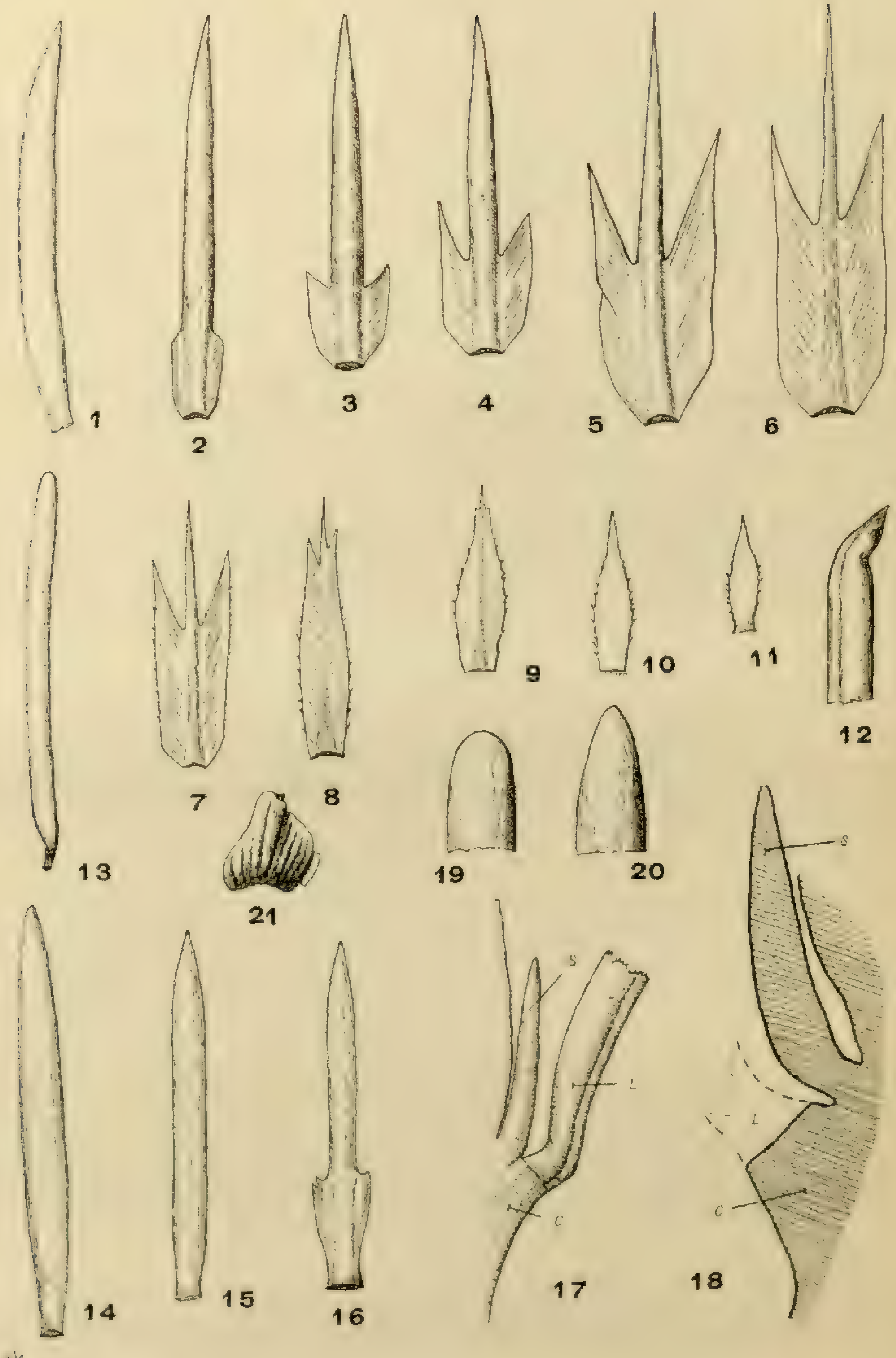
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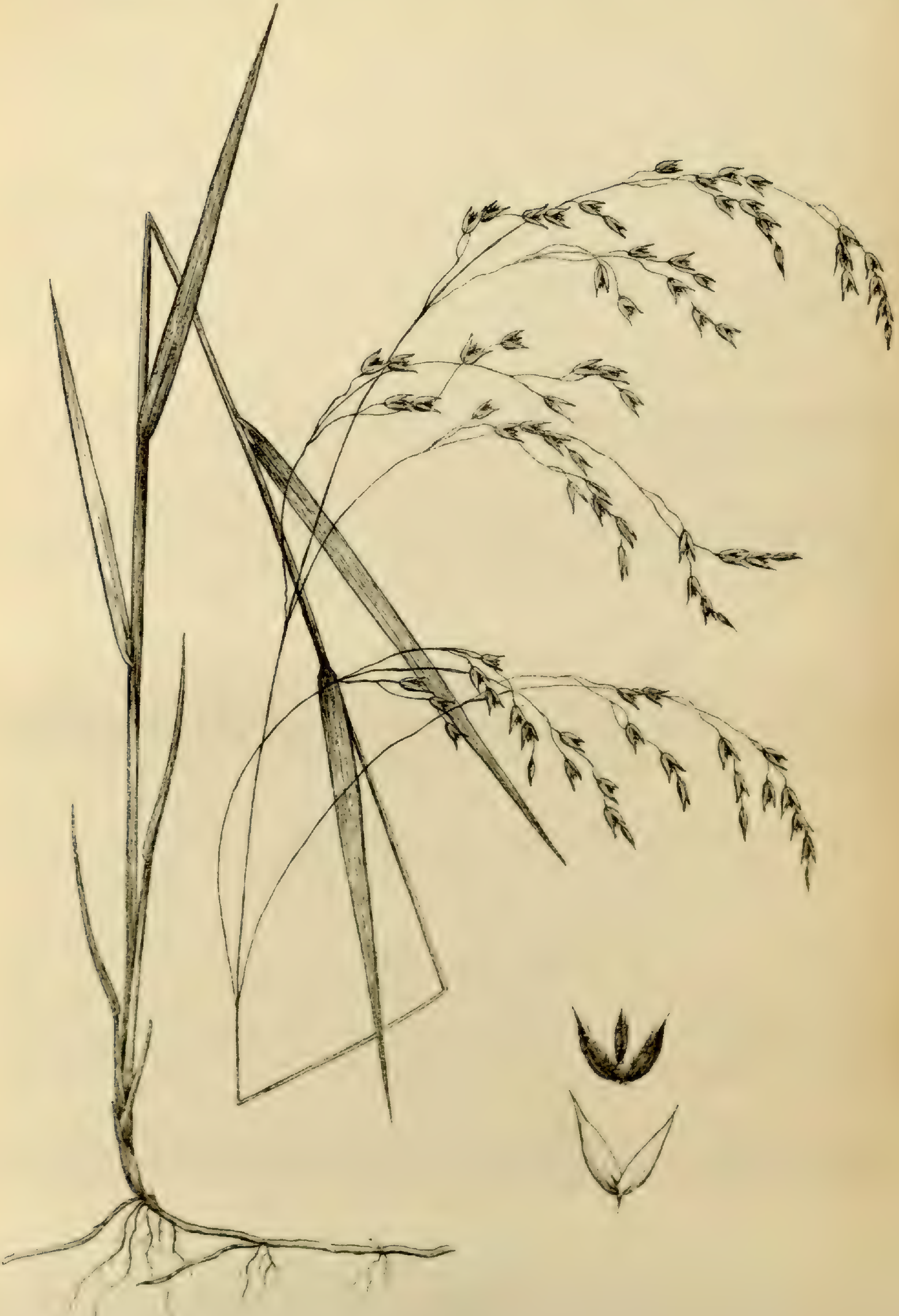

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BULLETIN
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MARCH 1898

New Compositae from New Mexico.

By Edward L. Greene.

(Plates 330–334.)

This paper embodies in brief some results of the critical study of a good collection of Compositae made in southeastern New Mexico in the summer of 1897; the special localities being the Sierra Blanca or White Mountain Range, the Organ Mountains, and the plains to the west of these ranges. The collector, Mr. E. O. Wooton, made a wise selection in choosing these little known parts of the vast territory of New Mexico as the field of a season's exploring.

I am not aware that, in the Sierra Blanca, any botanist has preceded him; and the ground being new, and, as a mountainous district, somewhat isolated from all other groups and ranges of New Mexican mountains, a considerable accession of new plants was to have been expected.

It will be noted, however, that the first of the forms here assigned specific rank, is not new, but heretofore has been imperfectly understood, and received as a mere variety of another species..

Coleosanthus petiolaris (Gray).

Resembling *C. grandiflorus*, but taller and loosely branching the inflorescence lax and leafy; stem and branches puberulent foliage nearly glabrous, pellucid-glandular, thin membranous, the leaf-outline hastate-deltoid, usually with a long acumination, the petioles slender, often nearly as long as the lamina: heads few and nodding in scattered small cymes: short oval and oblong outer bracts of the involucre obtuse, but caudate with a long slender herbaceous tip.

Organ Mountains, Sept. 1 (no. 490). I take this to be identical with *Brickellia grandiflora petiolaris* Gray, but its characters, as above indicated, are numerous. By the texture of its foliage, and the mode of growth, it is wholly distinct from *C. grandiflorus.* Its sufficiently well marked leaf-outline, and the slender petioles, pointed out by Gray, are of less importance than those characters which he did not detect. It is to be regretted that Mr. Wooton's specimens give no indication of what the lower parts of the plant are like, he having furnished us with only the terminal and flowering portion.

COLEOSANTHUS AMBIGENS.

Apparently herbaceous, 2° high or more, simple up to the rather strict and thyrsiform panicle of middle-sized heads; foliage green and seeming glabrous, but sparsely scabrous-puberulent under a lens: lowest leaves opposite, the pairs remote, very thin, deltoid-ovate, 2′ or 3′ long, acute, coarsely serrate-toothed, the upper and those subtending the branches of the panicle alternate, all with slender and rather long petioles: involucres ¼′ high, strongly imbricated, their bracts from ovate to oblong-linear obtuse and pointless, strongly nerved and tomentose-ciliate: flowers ochroleucous or cream-colored: achenes short for the genus, with 5 prominent angles and as many intervening ribs, not glandular, the angles and ribs scabrous-serrulate. [Plate 330.]

White Mountains, August 13 (no. 335). Plant with something of the aspect of *C. grandiflorus*; its root-growth not indicated; but very distinct in its short and much imbricated involucre of bracts passing very gradually from short to long, and also in the character of the achenes, which are far more like those of *Eupatorium*, the alternate angles being reduced to merely acute striae; they are almost those of *E. Fendleri*, yet in habit the plant is wholly *Coleosanthus*.

LACINIARIA LANCIFOLIA.

Stout, 3° high, glabrous: lowest leaves nearly 1° long, linear-lanceolate, 1-nerved, middle cauline more than half as long, broad in proportion and lanceolate, scarcely 3-nerved, *i. e.*, the lateral nerves indistinct: spike of heads rather loose, 6′–10′ long, the campanulate involucres hardly ½′ high; bracts many and imbricated, oblong but with triangular-ovate acutish and wholly herbaceous but purple tips, the margin ciliolate; pappus short and subplumose, little longer than the pubescent striate achenes.

In marshy land at 6800 feet in the White Mountains, July 31 (no. 254). Plant with much the general aspect of *L. spicata*, but very distinct in the character of its involucre, the bracts of which in *L. spicata* are elongated and conspicuously striate, ending in a short rounded and scarious-margined tip. In the new species the bracts are so short and closely imbricated that no striate base is exposed, and the wholly herbaceous and marginless tips are somewhat ovate and acute.

ASTER HESPERIUS WOOTONII.

Plant of ampler foliage than in the type; inflorescence decidedly corymbose-paniculate; bracts of involucre in several series, but nearly equal, the outer herbaceous and slightly broader than the inner, all acute: lower cauline leaves spatulate-lanceolate, 4′ or 5′ long, the upper narrowly lanceolate, all serrulate, scabrous on the margin: branches strongly pubescent in lines.

Eagle Creek, White Mountains, Lincoln County, August 12 (no. 329), at 7000 feet altitude.

CHRYSOPSIS FULCRATA.

Tufted perennial, the stoutish erect stems 2° or 3° high, the whole herbage green, papillose-granular and perhaps somewhat viscid beneath a minute scabrous pubescence, some rather stiffly hirsute longer hairs clothing the stems and leaf-margins: leaves oblong, obtuse, sessile, ascending, only about an inch long, venulose: heads rather large, short-peduncled, subcorymbose at summit of stem and branches, the involucres subtended and partly concealed by one or more leafy bracts; proper involucral bracts in few series: rays numerous and large, golden yellow: achenes silky; outer pappus very conspicuous, of 20–25 linear-acuminate paleae.

Collected at various places in the White Mountains and Organ Mountains at elevations of 6000 to 6500 feet (nos. 510, 511, 512).

ERIOCARPUM SERRATUM.

Tufted perennial, the erect somewhat corymbosely branched stems 1½° high; the whole plant scabrous-puberulent; leaves

1′ long or more, from spatulate-oblong to linear-oblong, obtuse, closely and evenly spinulose-serrate: heads rather large, solitary at the ends of the branchlets: involucre somewhat hemispherical, nearly ¾′ broad, its coriaceous herbaceous-tipped bracts closely imbricated in many series: rays many, rose-colored on lower side, white on upper: achenes silky-pubescent, scarcely compressed, indistinctly angled: pappus of unequal coarse and rather rigid bristles which are merely scabrous, the longest little longer than the achene. [Plate 331.]

White Mountains, at 6800 feet, July 30 (no. 251). A fine and strongly characterized new species, more closely resembling a *Grindelia* than is the type of the genus, *E. grindeloides;* perhaps nearly related to the annual *E. rubiginosum;* also unquestionably akin to *E. gymnocephalum* by its partially reddish ray-flowers.

ERIOCARPUM WOOTONII.

Perennial, diffusely branched and depressed, the branches 8′–10′ long, canescent with a soft loose somewhat cottony pubescence, not glandular: leaves small and narrow, of a linear rachis and several rather remote pairs of short divaricate spinulose-tipped lobes: heads terminating numerous short leafy branchlets: involucre broad, its bracts with cottony-tomentulose green tips: rays deep yellow. [Plate 330.]

On the White Mountains, at 6500 feet elevation; the specimens barely in flower Aug. 19 (no. 518). Species with habit of *E. spinulosum*, foliage more like that of *E. australe*, the pubescence wholly peculiar.

GRINDELIA SCABRA.

Biennial, 2° high, the rather slender reddish stem and branches and thin foliage scabrous-pubescent: lowest leaves oblanceolate, petiolate, those of the branches oblong, sessile by a broader and somewhat clasping base: all sharply but not deeply spinulose-serrate: hemispherical involucre of very numerous bracts, all with subulate-alternate suberect herbaceous tips: rays of a deep golden yellow: achenes very small, somewhat compressed-pyriform, smooth, or with two or more striae, destitute of terminal crown or teeth, and with but a minute areola: bristles of pappus 2 or 3, scabrous-serrulate on the margins below. [Plate 332.]

White Mountains at 6300 feet, August 21 (nos. 224, 372).

ERIGERON ARENARIUS.

Annual, slender, weak and diffusely branching from the base, the branches 1° long or less; herbage minutely and softly pubescent: leaves mostly 1′ long, spatulate-linear, obtuse: heads terminating slender pedunculiform sparingly leafy-bracted branchlets; involucre 2″ or 2½″ high, the equal bracts roughly hirsutulous: rays 40 or more, not very narrow, white to lavender: achenes elongated and linear, little compressed; pappus of some 20 very delicate bristles deciduous from a callous ring.

Sand hills near Mesilla, June 17 (no. 23). With the aspect of some forms of *E. divergens*, but more allied to *E. Bellidiastrum;* the pappus perfectly simple.

ERIGERON FORMOSISSIMUS.

Perennial, somewhat tufted, 1°–1½° high, the stems erect or at base slightly decumbent: basal leaves oblanceolate, obtuse, entire, 1-nerved, 2½′–5′ long including the long-winged petiole, green and glabrous on both sides, ciliolate-margined; those of the stem 1′ long or more, oblong-lanceolate, acute, sessile: stem somewhat hirsute-pubescent, ending in one or two very large heads: involucre low-hemispherical, ¾′ broad, the biserial equal bracts with spreading green tips and with little pubescence: rays 100 or more, narrow, almost ¾′ long, from light rose-color to deep purple. [Plate 332.]

The type from an altitude of 10000 feet on Sierra Blanca Peak of the White Mountains, Aug. 16 (no. 352). A taller stalk of the same was collected by the present writer, on northward slopes of the Pinos Altos Mountains in September, 1880, and distributed for *A. glabellus*, a species to which this is certainly allied. The expanded heads are nearly two inches in diameter. In the far northern species, *E. glabellus*, they are barely ¾ of an inch, and the rays are much narrower, white, or pale; the heads being several and corymbose.

WOOTONIA gen. nov.

Opposite-leaved and dichotomously branched annual, of the Coreopsideae. Heads solitary in all the forks. Involucre simple, of a series of distinct and equal oblong erect bracts; or occasionally with vestiges of an outer involucre in the form of one or more narrow and spreading bractlets. Rays none. Disk-flowers 5 or 6, minute. Achenes linear, compressed but never thin, with two thickish and obtuse angles and several intervening striae; the outer achenes glabrous, surmounted by a pair of stout divergent smooth and persistent awns which are channeled above, and runcinate at tip; inner achenes a fourth shorter than the others, pubescent and somewhat rugose-tuberculate, their awns shorter, stouter and divaricate.

✓WOOTONIA PARVIFLORA.

Stoutish annual 1° or 2° high; leaves ternately dissected into elongated and narrowly linear segments, the whole herbage glabrous: heads very small, on filiform peduncles, these much elongated in fruit and spreading or deflexed. [Plate 333.]

On plains near the White Sands, Doña Ana County, August 25 (no. 393). A quite distinct new type, about equally allied to *Bidens* and *Cosmos*, but impossible to be referred to either.

✓LAPHAMIA CERNUA.

Low and herbaceous stems from a short ligneous crown, only 3′ or 4′ high, with 3 or 4 pairs of rather ample leaves and a solitary terminal short-peduncled large head at first nodding and concealed beneath the leaves; plant nearly glabrous and slightly fleshy: leaves round ovate to deltoid-ovate, ¾′ long and as broad, coarsely and quite evenly dentate, the petiole rather longer than the blade: campanulate involucre nearly ½′ high: flowers dull orange yellow: rays none: corollas with short proper tube and long cylindric throat: outer and fertile achenes compressed, callous-margined, nerveless, puberulent, the inner infertile ones merely 4-angled; pappus in all of numerous very unequal barbellate bristles, the longest about equaling the proper tube of the corolla. [Plate 333.]

Organ Mountains, at 6500 feet altitude, September 4 (no. 476). A very distinct species, notable for its large solitary nodding heads.

SENECIO WOOTONII.

Stout, perennial, 2° high, leafy below, naked and loosely corymbose-panicled above, the whole plant glabrous from the first and glaucescent: leaves broadly or more narrowly lanceolate, 6′–10′ long, including the long winged and basally dilated petiole, the margins coarsely and obtusely dentate or serrate-toothed: heads ½′ high, numerous, erect, on long naked or linear-bracted peduncles; bracts of the campanulate involucre few and broad, thin-margined, acute: rays few, short, deep yellow: achenes columnar, glabrous, light-colored. [Plate 331.]

At an altitude of 7000 feet on the White Mountains, August 15 (no. 491). Not intimately allied to any other species; the glabrous glaucescent herbage somewhat like that of *S. microdontus*, but inflorescence and large heads of the group to which *S. Bigelovii* and its allies belong.

TETRADYMIA FILIFOLIA.

Compact low shrub, with short very leafy branches, but no fascicled foliage: leaves all filiform, ½′ to 1½′ long, ascending or suberect, permanently tomentose, as are all the leafy branchlets: heads few, terminating all the branchlets, 4-flowered; involucre short, of two oblong-linear and two oblong-ovate bracts, all obtuse and with arachnoid-ciliate margins: achenes glabrous; pappus long, of rather copious bristles, all abruptly dilated and serrulate at tip. [Plate 334.]

On Round Mountain of the White Mountain Range, at 5000 feet, July 21 (no. 183). Very distinct species, quite isolated from the rest of the genus geographically.

CARDUUS PERENNANS.

Rather slender, 3° high, from apparently deep-seated perennial roots, the herbage arachnoid-woolly when young, the maturer foliage glabrate above, white-wooly beneath: stem and few flowering branches leafy, even up to the few and scarcely pedunculate heads: lowest leaves lanceolate, subentire and spinose-ciliate‘ the others with shallow lobes: heads 1½′ high, ovate, the coriaceous and not strongly imbricated bracts arachnoid-wooly along the margin only, showing a narrow glutinous spot, and tipped with a stout somewhat spreading spine; flowers red or purplish: anther-tips attennate-subulate: some of the outer pappus bristles not at all plumose, and only sparingly barbellulate.

White Mountains, at 7000 feet, Aug. 12 (no. 326) and Organ Mountains, July 7. One of the very few perennial species indigenous to North America. In aspect more like *C. Arizonicus* than any other.

PTILORIA NEO-MEXICANA.

Tufted and much branched perennial, the slender reedy branches 1° to 2° high, clothed with a few linear and linear-subulate entire leaves and leafy bracts, the whole plant glabrous and glaucous: scattered involucres less than ½′ high, 5-flowered: achenes columnar and pentagonal, covered with minute sharp interrupted transverse rugosities; pappus white, of about 15 bristles loosely long-plumose from toward the base, the basal part naked and scabrous and slightly thickened.

Mesas near Las Cruces, July 2 (no. 482). A species that may include much of the southern so-called *Stephanomeria minor*.

AGOSERIS GRAMINIFOLIA.

Perennial, 1° high or less, glaucous, the foliage glabrous, but scapes sparsely pilose below, woolly under the glabrous involucre: leaves all very narrowly linear, entire, acuminate: heads 1′ high, narrow and few-flowered: bracts of the involucre in about 3 series, ovate-lanceolate to linear-lanceolate: achenes gradually narrowed to a beak shorter than the body; pappus white, rather coarse, hardly scabrous. [Plate 334.]

At 7000 feet altitude in the White Mountains, in moist land, August 13 (no. 513), in fruit only.

Explanation of Plates.

PLATE 330, 1 and 2. *Eriocarpum Wootonii* Greene. 1. A portion of a plant half natural size. 2. Involucral bracts and flowers natural size. 3 and 4. *Coleosanthus ambigens* Greene. 3. A portion of a plant half natural size. 4. Involucral bracts, flower and achene natural size; also achene × 2.

PLATE 331, 1 and 2. *Senecio Wootonii* Greene. 1. Part of plant half natural size. 2. Involucral bract and ray flower natural size. 3 and 4. *Eriocarpum serratum* Greene. 3. A portion of a plant half natural size. 4. Ray-flower and achene natural size.

PLATE 332, 1 and 2. *Grindelia scabra* Greene. 1. A portion of a plant half natural size. 2. Involucral bract, ray flower and achene natural size. 3 and 4. *Erigeron formosissimus* Greene. 3. A portion of a plant half natural size. 4. Involucral bract, ray flower and achene natural size.

PLATE 333, 1 and 2. *Wootonia parviflora* Greene. 1. Entire plant half natural size. 2. Head of flowers and achenes natural size. 3 and 4. *Laphamia cernua* Greene. 3. Part of the plant natural size. 4. Involucral bract and flower natural size.

PLATE 334, 1 and 2. *Agoseris graminifolia* Greene. 1. A portion of a plant half natural size. 2. Achene natural size. 3 and 4. *Tetradymia filifolia* Greene. 3. Small branch of a plant half natural size. 4. Head, with one bract and three flowers removed, natural size.

Selaginella rupestris and its Allies.

By Lucien Marcus Underwood.

The variations of the species of *Selaginella* with many-ranked leaves have long been a puzzle to botanists if we may judge from the numerous herbarium and MS. names that have been given to various members of the group. Two clearly marked species from North America have been separated from the tangle already; besides these there remain the boreal *S. selaginoides* on which Beauvois founded the genus, and which needs no consideration here, and the widely varying forms that for the past forty years have found an unsatisfactory resting place under *S. rupestris*. For many years it has been evident that we have in this group several species as well marked as those which have been segregated already. In 1889 one of these species was found growing at Pasadena, California, and when in 1891 another was seen growing erect in sand fields in central Florida, the polymorphous nature of the group was even more forcibly impressed on us, and with it the impossibility of maintaining such divergent forms under a single species. Recognizing the fact that without abundance of material at hand and especially without consulting the largest collections not only of America but also of Europe, the description of new species would be a hazardous matter, we have hesitated until the great mass of material, especially at Kew, could be satisfactorily examined, meanwhile continuing to refer the various forms provisionally as variations of *S. rupestris*. We are now convinced that it is more logical as well as more scientific to designate these clearly marked forms by specific names. Even now, however, we are obliged to leave several well marked forms undescribed for lack of sufficient material and shall call attention to them briefly, in the hope that our field collectors in the west, in the southwest and in Mexico may give them better attention. The larger number of the species proposed below are comparatively local in their distribution; most of them are confined to the region west of the Mississippi.

1. SELAGINELLA RUPESTRIS (L.) Spring.

It may be something of a surprise to many to learn that the original or type locality of this somewhat widely distributed species is in the eastern United States, and it is here where it appears to be subject to comparatively slight variation. Since the original *Lycopodium rupestre* of Linnaeus had a distribution extending to Siberia, it is possible that this species, like many others, was a composite, but as Linnaeus after his usual brief diagnosis cited the excellent figure of Dillenius,* which the latter had characterized as the sharp square-spiked rock lycopod from Virginia and Pennsylvania, it is clear that whatever the status of the Asiatic plant, the plant of the eastern United States must bear the specific name assigned to it by Linnaeus.

Spring in his revision of the species † recognized two extremely generalized varieties neither of which clearly represents any plant in particular. His var. *α borealis* included the more rigid contracted forms which he attributed to the northern regions of Asia and America, while his var. *β tropica* included the more slender elongate forms from warmer latitudes. It is interesting to note in this connection that the most elongate member of the group, attaining, according to Professor D. C. Eaton,‡ a length of six feet, is found on the Pacific coast from Oregon to southern Alaska.

Milde§ distinguishes ten varieties, but as only one of them was American, and that from Mexico, his arrangement does not specially concern us at this time.

Baker still later ‖ united all the forms under a single species with a note in which he mentions *S. tortipila* as "a dwarf form" and cites two herbarium names of Nuttall. Singularly enough he recognizes *S. Oregana* D. C. Eaton as distinct, although the specimens of that species at Kew are all mixed up with the various forms of *S. rupestris*, often on the same sheets, and the cover for *S. Oregana* appears to be vacant. But this unceremonious massing of widely different species under the same cover is not uncommon in the Kew collection.

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* Historia Muscorum, *pl. 63. f. 11.*

† Monographie de la Famille des Lycopodiacées, seconde partie, 57. 1848.

‡ Bot. Cal. **2**: 350. 1880.

§ Fil. Europ. et Atlant., 262, 263. 1867.

‖ Handbook of Fern Allies, 35. 1887.

The species as here limited may be characterized as follows:

Stems creeping, 5–10 cm. long, more or less flexuous, the apices ascending, subsecund, abundantly emitting roots throughout their entire length; primary branches mostly short with 3–6 shorter secondary ones: leaves closely imbricate, about 8-ranked, spreading at the apex of sterile stems, narrowly lanceolate, 0.3–0.38 mm. wide, deeply channeled dorsally, ending in a subflexuous spinulose white awn nearly 1 mm. long; margins each with 6–9 slender cilia: spikes sharply quadrangular, 1–1.5 cm. long, about 1 mm. in diameter; bracts similar in texture to the leaves but broader at the base, with a shorter and stouter terminal awn and usually with more cilia on the margin.

On rocks, New England and Ontario, southward throughout the Appalachian region, westward to Missouri, Colorado, Idaho, Wyoming, California and British Columbia, extending to 7000 feet altitude.

Specimens collected by Kearney in eastern Tennessee have the leaves more lax, and more spreading branches, due, perhaps, to growth in moister places. Specimens growing in mountain exposures, particularly in the far West show shorter more incurved sterile branches and assume generally a more compact form of growth doubtless for better conserving their supply of moisture, but in all other characters do not differ essentially from the more typical eastern form. It will be a fortunate day when field collectors take more time to study in the field the environment of the plants they collect.

1a. SELAGINELLA RUPESTRIS FENDLERI var. nov.

Differs from the Eastern forms of the species in its lax, less crowded leaves which are tipped with a shorter white awn and their margins with short denticulate cilia; the spikes are flabby and flexuous, and the macrospores are more coarsely areolate.

Fendler, no. 1024, Plantae Novo-Mexicanae, 1847; Fort Collins, Colorado, C. F. Baker, no. 2. I would also refer to this variety a single sterile plant collected in the Organ Mountains, New Mexico, by E. O. Wooton, 1892.

2. SELAGINELLA WATSONI sp. nov.

Stems short, 4–6 cm. long, creeping, sparingly short branched, rooting throughout the entire length; leaves rather short, stout, deeply channeled dorsally, ending abruptly in a short stout smooth mostly curved green awn, 0.25–0.35 mm. long; margins with few cilia or none, when present not exceeding 70μ in length; spikes 1.5–2.5 cm. long, sharply quadrangular, the bracts broader at base, lanceolate-ovate to ovate, with shorter and stouter awns.

Apparently confined to high altitudes of the Sierra Nevada and neighboring mountains. Cottonwood Cañon, Utah, alt. 9500 ft., S. Watson, no. 2370, in King's Expl. Exped., July, 1869; Clover Mts., Nevada, alt. 9000 ft., S. Watson, Sept., 1868. (U. S. Nat. Herb.); Cañon Pass (Sierra Nevada) alt. 8000–9000 ft., Aug., 1863 (Herb. D. C. Eaton); Alpine Co., California, alt. 8000 ft., Hansen (Herb. D. C. Eaton) also Hansen, 879 (Herb. Kew); Mt. Whitney, Tulare Co., California "1700 ft. above timber line" Coville & Funston, no. 2071, Death Valley Expedition.

✓ 3. Selaginella mutica D. C. Eaton MS. in Herb.

"Stems creeping, rather rigid, 3′–6′ long, divided and pinnately branched; leaves glaucescent, six-ranked, closely imbricated, half a line long, oblong-ovate, convex and slightly grooved on the back, obtuse and without a terminal seta, the margins ciliated with about eight spreading cilia on each side; spikes scarcely thicker than the branches, quadrangular, the bracts broader than the leaves and pointed or even obscurely mucronate."

"Collected in New Mexico by the Mexican Boundary Commission and in several places in Colorado by Thomas Meehan, Mrs. E. J. Spence, etc."

This clearly marked species I have found described as above in Professor Eaton's collection and would add the following characters partly in emendation of those noted above. The cilia on the margins of the leaves are often 12–15 on either side (even in Eaton's specimens), are long and slender, often 120 μ or longer; the channels on the dorsal surfaces of the leaves are as clearly marked as in *S. rupestris.* The stems are well provided with roots throughout their whole extent.

Additional specimens in the Columbia Herbarium were collected in Colorado by Brandegee, A. G. Compton and Mrs. Livermore; also specimens from La Cuerba, New Mexico, Bigelow, 1853, Whipple's Exped. My own herbarium also contains specimens from Prescott, Arizona, J. W. Tuomey. In the U. S. National Herbarium are additional specimens collected on the Mexican Boundary Survey.

4. SELAGINELLA ARENARIA sp. nov.

Deeply rooting in sand with fine copious roots often 15–20 cm. long; stems slender, branching, erect or ascending, densely caespitose, 5–8 cm. high, emitting copious brown wiry roots a little distance above the base; leaves closely appressed, narrowly lanceolate, 0.25 mm. wide, deeply channelled dorsally, terminated by a spinulose white awn 0.35–0.50 mm. long; margins with numerous short cilia; spikes 2–3 cm. long, slender, sharply quadrangular, the bracts broadly lanceolate, spreading at maturity with copious marginal cilia (15–20 on either side); microspores very abundant throughout the length of the spike, globose-tetrahedral, 36–39 μ in diameter, bright yellow or pale orange.

Growing in sand in open fields, Eustis, Florida, Jan., 1891, Underwood; July, 1894, Nash, no. 1449. A fragmentary specimen of the same plant is in the Chapman Herbarium and bears the note "Dry sand ridges, Gadsden Co., Florida, 1840." In addition to the remarkable habit and habitat of this species it produces a great abundance of microspores unlike the other members of the *rupestris* group.

In the Gray Herbarium there is a MS. description by Riddell with meagre specimens of plants from western Louisana and Texas which resemble the above species in habit but have spikes scarcely more than one-third as long; they may prove a distinct species, when Riddell's appropriate name should be taken up. To the same species we should refer plants of Drummond's Texas collection (Herb. Columbia and Herb. Kew), Riddell, no. 16 in Herb. Columbia and Reverchon's Texas Plants no. 1632, from Burnet county, on granite rocks, though the latter specimens show some slight variations particularly in the irregular ranking of the leaves.

5. SELAGINELLA RUPINCOLA sp. nov.

Stems suberect, somewhat flexuous, 8–12 cm. high, rooting only from near the base, pinnately branching, the secondary branches mostly very short; leaves channeled dorsally, closely imbricate, spreading only near the growing tips of the stem, glaucous or cinereous green, tapering toward the apex and ending in a long white denticulate spine 1 mm. or more long; margins strikingly long ciliate, 15–20 on either side; spikes 1 cm. or less long, borne laterally on the branches, scarcely quadrangular, the bracts closely resembling the ordinary stem leaves so as to render the spikes scarcely distinguishable except for the axillary sporangia; macrospores dark-yellow, 0.24–0.27 mm. in diameter, strongly and deeply pitted reticulate.

On perpendicular rocks, Organ Mts., Doña Ana Co., New Mexico, alt. 6000 ft., E. O. Wooton, July 10, 1897. No. 2106 of Wright's collection, 1851–2 (Herb. Kew) belongs here, as also the erect plant of Palmer's no. 92, southwestern Chihuahua, 1885 (Herb. Kew); as represented in the Columbia herbarium, this number includes a second creeping sterile plant which belongs to a distinct species. A sterile plant in my herbarium, collected by Tuomey in the Santa Catalina Mts., Arizona, also appears to be the same species.

The macrospores of this species are only about half the diameter of those of *S. rupestris*. The plant evidently approaches what Milde had in mind in his var. *Mexicana*, but that is characterized as having "rami laxius dispositi longiores" and a "seta brevis parce denticulata," neither of which our plant possesses.

✓6. SELAGINELLA BIGELOVII sp. nov.

Stems slender, 10–20 cm. long, mostly ascending, flexuous, usually with short ascending primary branches; secondary branches infrequent and mostly very short; stems rooting only near the base; leaves about six-ranked, appressed-imbricate, usually with a distinct dorsal channel, narrowly lanceolate, tapering gradually into a densely spinulose white awn often 0.7 mm. long; margins with 12–15 cilia on either side which are directed forward and usually less than 50 μ long; spikes obtusely quadrangular, mostly on short lateral branches 5 mm. or less long, the bracts short, broadly ovate but otherwise like the leaves.

The original specimens collected by Bigelow (Whipple's Expedition) probably in California but without locality stated, appear to be sterile, but specimens collected by me at Pasadena, California, in January, 1889, and clearly referable to this species have a few fertile spikes from which the characters above noted are derived. The later specimens are usually more branched than those of Bigelow's original collection but are otherwise closely similar. To this species we would also refer Parish no. 671, San Bernardino, Coville & Funston no. 101 from the same locality, and specimens collected from "San Ysabel" by H. W. Henshaw.

7. SELAGINELLA TORTIPILA A. Br. Ann. Sc. Nat. V. **3**: 2. 1865.

Stems 20–25 cm. long, more or less flexuous, with the elongate primary branches compound, rooting only near the base; leaves loosely imbricate, about six-ranked, narrowly lanceolate, scarcely channeled dorsally, ending in a contorted or irregularly coiled elongate hair point; margins with 6–12 very short cilia on either side: spikes very short (4–5 mm.) borne at the ends of ordinary branches, subquadrangular, but with loosely spreading broadly ovate-lanceolate bracts, which are dorsally channeled and bear marginal cilia and terminal hairs similar to those of the stem leaves.

Described from the type specimen, a duplicate of which, mixed with *S. rupestris*, has recently come into our possession, "In locis rupestribus humidis montium ad Broad River, Carolina, Sept. legit Rugel, July, 1841." Fragmentary specimens had hitherto been seen from Caesar's head, South Carolina, and from Saboola Mountain, Macon County, North Carolina, both collected by J. Donnell Smith.

This is the species which Baker describes as "a dwarf form" of *S. rupestris*, but which Milde characterizes very justly as "species pulcherrima!" The plant is much more elongate though more slender than *S. rupestris*, with which it has otherwise little in common.

8. SELAGINELLA EXTENSA sp. nov.

Stems slender, trailing, 35–40 cm. long, copiously emitting roots throughout their whole extent, with numerous primary branches 1.5–4 cm. long; leaves dark green, narrowly lanceolate with a slight dorsal channel, ending in a very short brownish or translucent point, mostly with no terminal spine: marginal cilia few, appearing like minute serrulations: spikes single or often in pairs at the ends of the primary branches, 1–2 cm. long, the bracts broadly lanceolate, ending abruptly in a point, strongly ciliolate on the margins.

On rocks and trees, Las Canoas, San Luis Potosi, Mexico. Pringle, no. 3900, August 21, 1891. Specimens are also in the Meissner Herbarium, collected in Mexico by C. Müller.

The plant was distributed under the name of *Selaginella rupestris*, var. *Mexicana* but it has nothing to do with the var. *Mexicana* Milde, Fil. Europ. et Atlant. 263. 1867, and this necessitates the adoption of a new name, as it properly deserves specific rank.

9. SELAGINELLA STRUTHIOLOIDES (Presl).

Lycopodium struthioloides Presl, Rel. Haenk. **1**: 82. 1830.
Selaginella Oregana D.C. Eaton; Bot. Cal. **2**: 350. 1880.

This plant should be restored to its proper name under which it was well described a half century before its second christening. Hooker[*] years ago recognized the identity of Presl's plant with the one collected by Scouler at Observatory Inlet, the specimen of which is preserved at Kew and agrees perfectly with the plant known from the Oregon woods whence it has been collected by numerous later explorers and distributed under various names. Singularly enough, Baker,[†] with Scouler's plant before him, referred *Lycopodium struthioloides* Presl which was originally described from "Nootka Sund" to *L. carinatum* Desv., a true *Lycopodium* from tropical Asia! It is so simple in certain quarters to overleap all geographical barriers in the effort to mass species.

The species above characterized can be readily separated by the following synopsis:

- Stems spreading or creeping.
  - Stems close creeping, usually less than 10 cm. long, rooting their entire length.
    - Leaves tapering into a conspicuous slender white awn. 1. *S. rupestris.*
    - Leaves ending abruptly in a minute greenish point. 2. *S. Watsoni.*
    - Leaves six-ranked, closely appressed, without awns or points. 3. *S. mutica.*
  - Stems spreading, 20–25 cm. long, rooting only at the base; spikes 4–5 mm. long leaves ending in a tortuous white hair. 7. *S. tortipila.*
  - Stems extensively trailing, 35 cm. to 1 meter or more long.
    - Stems scarcely rooting, 50–150 cm. long, lax with soft spreading leaves. 9. *S. struthioloides.*
    - Stems everywhere rooting, 35–40 cm. long, rigid with appressed leaves. 8. *S. extensa.*
- Stems erect or ascending.
  - Spikes 2–3 cm. long, plants deeply rooting in sand. 4. *S. arenaria.*
  - Spikes 1 cm. or less long.
    - Leaves eight-ranked, with conspicuous long spreading cilia; spikes scarcely quadrangular. 5. *S. rupincola.*
    - Leaves six-ranked, slightly ciliate; spike quadrangular. 6. *S. Bigelovii.*

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[*] Fl. Bor. Am., **2**: 267. 1840.

[†] Handbook of Fern Allies, 17. 1887.

Besides the above species there are a number of interesting forms that are peculiar in standing strictly by themselves, having for the most part no very close alliances; the material in every case is scanty and for the greater part consists of wholly sterile plants; in order to call the attention of collecters to these forms they are briefly characterized; they are mostly found in the region extending from Texas to southern California and northern Mexico, a region already prolific in well marked species, and are particularly commended to botanists living or collecting in this portion of the country.

1. A prostrate plant with strongly secund leaves, usually showing a distinct dorso-ventral character both in color and arrangement of leaves; two forms occur, one with no hair point to the leaves and the other with a well developed hair point. To the former belong Parish, no. 1200, San Bernardino, California; Palmer, no. 455, southwestern Chihuahua, 1885; and a small plant collected by Major Emory in 1846. To the latter type belong Nealley, no. 555, Chenates, western Texas, 1889; and a plant collected by Fremont in California, 1845–7. All these forms are sterile.

2. A form with short rosette-like stem and leaves closely compacted and ending in a minute point. A mere scrap of this was collected in Inyo Co., California, by Coville and Funston, no. 628, Death Valley Expedition; a quite similar plant in Herb. Kew. is marked "*L. bryoides* Nutt." from San Diego and is presumably the plant referred to by Baker in his note under *S. rupestris*.

3. A very small creeping form with closely appressed scarcely pointed leaves and short clavate branches; a single meagre specimen collected on the Mexican Boundary Survey by Dr. Parry is in the Columbia Herbarium; a similar specimen in the Herb. Phila. Acad. Sciences is marked "*Lycopodium bryoides*" in Nuttall's own hand, while another specimen in Herb. Kew bears the mark, "*L. rupestre β brevipes*, Oregon, Nutt." All these sterile forms represent an interesting form and in connection with the facts above stated indicate clearly that the last word has yet to be said in regard to the members of this interesting group of species.

15 February 1898.

Studies in the Botany of the Southern United States.—XIII.

By John K. Small.

I. SPECIES HITHERTO IMPERFECTLY UNDERSTOOD.

✓ Baptista laevicaulis (A. Gray).

Baptista leucophaea var. *laevicaulis* A. Gray; Bot. Gaz. **4**: 132. 1879.

Perennial, nearly glabrous. Foliage turning blackish in drying: stems erect, 3–7 dm. tall, branching: leaves 3-foliolate; leaflets leathery, obovate or cuneate-obovate, 4–8 cm. long, mucronulate to retuse at the apex, delicately reticulated: racemes somewhat declined, 1–3 dm. long, 1-sided: pedicels 3–6 cm. long, subtended by ovate or oblong-lanceolate acute bracts: calyx pubescent within, 1 cm. long, prominently nerved; segments, except the upper one, lanceolate or ovate-lanceolate, about as long as the tube: corolla dull yellow; standard orbicular-ovate, 2 cm. in diameter, deeply cleft, rather abruptly narrowed into the short claw; wings and keel-petals with blades over 2 cm. long: pods firm, oval, 3–4 cm. long, with a slender curved beak and a stipe at least as long as the calyx.

On prairies, Louisiana and Texas.

A large species with the general habit of *Baptista leucophaea*, but with almost glabrous foliage. The only pubescence on the leaves and their stipules is a sparse villous ciliation. The stems and inflorescence are glabrous or practically so, save the dense lustrous pubescence lining the inside of the calyx-tube and covering the ovary.

The first specimens were collected by Dr. Hale in Louisiana, number 210. Mr. Langlois found the species in Calcasieu and St. Landry Counties, western Louisiana in the years 1884 and 1885. As the species has been described but imperfectly as a variety, I have given the above description.

✓Kraunhia macrostachys (T. & G.).

Wistaria frutescens var. *macrostachys* T. & G. Fl. N. A. **1**: 283. 1838.

Wistaria macrostachys Nutt.; T. & G. Fl. N. A. **1**: 283. As synonym. 1838.

A vine climbing over bushes or trees, 1–7 meters high. Stems more or less branched, becoming 2–3 cm. thick: leaves 2–3 dm. long or rarely shorter: leaflets usually 9, ovate or oval-ovate to elliptic or elliptic-lanceolate, 3–7 cm. long, acuminate, ciliate, rounded or cordate at the base: racemes 2–3 dm. long, loosely-flowered, drooping; rachis and pedicels densely hirsute and glandular: calyx pubescent like the pedicels; tube campanulate; segments lanceolate or narrowly-lanceolate, acuminate, the lateral ones about as long as the tube and the lowest one much longer: corolla lilac-purple or light blue; standard with a short claw and suborbicular blade, this rather broader than high, 1.5 cm. in diameter, acuminate at the base; wings 1.5 cm. long, the subulate-linear spur about as long as the claw: pods 5–10 cm. long, torulose, reddish-brown, rather obtuse: seeds oblong or cylindric-oblong, black, lustrous.

In swamps, Missouri to Tennessee and Arkansas. Spring.

Missouri. *Eggert.*

Tennessee: Covington, 1881, *Byars;* Forked Deer River, 1893, *Bain.*

Arkansas: Craighead county, 1893, *Eggert.*

Sufficient material has now been collected to prove this *Kraunhia* of the central Mississippi Valley a perfectly distinct species. This fact was observed by Mr. Nuttall many years ago. The elongated racemes with their rather shaggy hirsute and glandular pubescence readily separate the plant from the eastern *Kraunhia frutescens.* Strong characters are furnished by the flowers; the calyx-segments are as long as the tube, or the lower one longer, and the blade of the standard is decurrent on its claw. In *Kraunhia frutescens* we find contrasting characters for all these parts.

I have received valuable field notes from Mr. Henry Eggert, Dr. James Byars and Prof. S. M. Bain.

✓HIBISCUS INTEGRIFOLIUS (Chapm.).

Hibiscus coccineus var. *integrifolius* Chapm. Fl. S. States, Ed. 2, 610. 1884.

Hibiscus semilobatus Chapm. Fl. S. States, Ed. 3, 52. 1897.

As indicated in the preceding line, during the past year this neglected plant was given specific rank, but unfortunately under an untenable name. The comparatively blunt calyx-segments furnish a character not yet noted as a means of distinguishing between the present species and *Hibiscus coccineus.*

✓PHACELIA BOYKINII (A. Gray).

Phacelia fimbriata var. *Boykinii* A. Gray, Proc. Am. Acad. **10**: 320. 1875.

Annual, sparingly strigillose. Stems erect, more or less branched, 1–2 dm. tall, glabrate in age: leaves 1–3 cm. long; blades pinnatifid, rough, the lower ones petioled, the upper sessile; segments obtuse, abruptly pointed or mucronate: racemes many-flowered, 3–7 cm. long: pedicels erect, about as long as the calyx at maturity: calyx bristly; segments oblong, 3–3.5 mm. long, prominently nerved, obtuse: corolla bluish, 7–8 mm. broad; segments oblong-obovate, laciniate; appendages obsolete: filaments exserted, sparingly villous: capsules ovoid-globose, 2.5 mm. in diameter.

In dry soil, Columbus, Georgia.

There can be no doubt that this form is specifically distinct from *Phacelia fimbriata* and other related species. The firmer texture of the foliage, the rigid stems and branches, the abruptly pointed or mucronate leaf segments, the many-flowered narrow racemes with their short pedicels, the small corollas and small capsules are characters separating the plant from *P. fimbriata.* The original specimen was collected by Dr. Boykin in 1839.

II.—NEW SPECIES OF HERBACEOUS PLANTS.

✓THALICTRUM CAULOPHYLLOIDES.

Perennial by a horizontal rootstock, deep green, glabrous. Stems erect, 6–12 dm. tall: leaves 2–5 dm. long, spreading, with long petioles: leaflets firm; blades oval to suborbicular in outline, often broader than long, 4–9 cm. in diameter, glaucous and prominently nerved beneath, cordate or truncate, 3–5-lobed above the middle; lobes apiculate: petiolules slender, 5–30 mm. long: pedicels 8–20 mm. long, wire-like: fruit elliptic, 6 mm. long, sharply ribbed, contracted into stipes 1.5–2 mm. long, tipped by the persistent club-shaped style.

On mountain slopes, Tennessee. Spring and summer.

I have suspected the existence of another species of *Thalictrum* in the southern Alleghanies for several years. This winter Prof.

Ruth sent me mature specimens of the hitherto imperfectly understood form which I have just described. The leaflets of the species bear a strong resemblance to those of *Caulophyllum thalictroides*, whence the specific name. In this respect they differ from those of the nearest relative, *Thalictrum coriaceum*. The best character, however, exists in the fruit which is larger and narrower than that of *T. coriaceum*. The style is one-half as long as the achene or shorter and is club-shaped, thus differing from the longer style of its relative, which is subulate at maturity. The type specimen was collected by Prof. Ruth on mountain sides, Cade's Cove Mountain, Tennessee, July, 1892, number 1800.

CAPNOIDES HALEI.

Annual, glabrous, bright green. Stem branched at the base; branches spreading or ascending, 1–3 dm. long, simple or sparingly branched: leaves glaucescent beneath, the lower ones with petioles longer than the blades, the upper ones sessile, all dissected; segments rather coarse, acute: racemes erect, peduncled, 2–5 cm. long: bracts ovate to elliptic, acuminate: pedicels 2–5 mm. long, stout: corolla yellow, about 1.5 cm. long, the spur obtuse, much shorter than the body, the outer petals with thin incised-toothed crests: capsules stoutish, 2 cm. long, straight, erect or nearly so, on short, almost erect pedicels.

In dry soil, Florida to Louisiana. Spring.

Specimens of the species here described were collected many years ago in Louisiana by Dr. Hale, and lately Mr. Curtiss has distributed excellent material from the vicinity of Jacksonville, Florida, representing his number 4515, at least in part.

Capnoides Halei is most closely related to *Capnoides curvisiliquum* from which it may easily be distinguished at sight by its more slender habit, and especially by the more coarsely dissected leaf-blades; the corolla is of a much less brilliant yellow and the spur is much shorter than the body, whereas, in *Capnoides curvisiliquum* the spur and body of the corolla are equal in length. The capsules are erect or nearly so and straight as compared with the curved pods of its relative.

WALDSTEINIA PARVIFLORA.

Perennial by horizontal rootstocks, glabrous or villous-hirsute. Leaves basal, 1–3 dm. tall: petioles much longer than the blades and usually less pubescent than the scapes: blades 3-foliolate; leaflets cuneate-obovate or broadly rhomboidal, 2–8 cm. long, coarsely and irregularly crenate or lobed: scapes erect, solitary or several together, commonly shorter than the leaves, more extensively corymbosely branched: calyx usually pubescent, often nodding; tube broadly turbinate, 2.5–3 mm. long; segments triangular-lanceolate or lanceolate-acuminate, often shorter than the tube: petals linear oblong or narrowly elliptic, shorter than the calyx-segments or slightly longer: achenes obovoid, 3 mm. long.

In woods or shaded soil, southwestern Virginia, North Carolina, Tennessee and Georgia. March to May.

Recent collections from the Southern States bring to light a third species of *Waldsteinia* for the North American flora. The new species may be distinguished from *W. fragarioides* by the more prominent disk, the small sessile petals which are about as long as the calyx-segments or shorter, and the larger obovoid achene. I have seen the following specimens:

Virginia: Marion, June, 1892, *Mrs. Britton* and *Miss Vail.*

North Carolina: Dunn's Mountain, April 20, 1896, *Small.*

Tennessee: Dandridge, March, 1842, *Rugel*; Knox county, May, 1897, *Ruth*, number 2140.

Georgia: Toccoa Falls, August 8, 1893, *Small*; Gainsville, April 20, 1897, *Huger.*

NEPTUNIA FLORIDANA.

Perennial, diffuse. Foliage sparingly pubescent or glabrate, bright-green: stems several from large roots, ascending or spreading, 3–7 dm. long, commonly branching, more or less scabro-pubescent: leaves rather numerous, with 3–5 pairs of pinnae: stipules lanceolate, acuminate: leaflets oblong or narrowly-oblong, 4–5.5 mm. long, often mucronulate, ciliate, prominently 3-nerved, sessile: peduncles slender, much longer than the subtending leaves: heads oval or oblong, 1–1.5 cm. long: pods oblong, 2.5–3.5 cm. long, apiculate, rather lustrous, glabrous: stipe 2–4 mm. long: seeds 5–10.

In sand, Florida to Louisiana.

Heretofore confused with *Neptunia lutea*, but very different. Easily distinguished by the glabrate or sparingly pubescent foliage, the long slender peduncles and the oblong glabrous rather many-seeded pods with short stipes. I note the following specimens:

Florida: *Chapman*, various collections; St. Marks, June, 1843. *Rugel;* between Everglades and Biscayne Bay, *Curtiss*, no. 726; Eustis, Lake County, May and June, 1894, *Nash*, no. 686.

Louisiana: *Hale.*

BAPTISIA HUGERI.

Perennial, minutely pubescent. Foliage but little changed in drying: stems erect, 3–6 dm. tall, branching: leaves 3-foliolate, variable; stipules lanceolate or linear-lanceolate, 1.5–2 cm. long, acute; leaflets elliptic, somewhat acuminate at both ends or those of the lower leaves oblanceolate, 5–6 cm. long, somewhat lustrous above, the minute pubescence often abundant at the nerves, these conspicuous: racemes about 1 dm. long, few-flowered: pedicels 4–6 mm. long, with bracts similar to the stipules: calyx campanulate, 6–7 mm. long; segments, except the upper one, lanceolate-acuminate, about as long as the tube: corolla bright yellow; standard with a suborbicular notched blade about 12 mm. in diameter; wings nearly 2 cm. long, their blades almost oblong; keel petals similar to the wings, but oblong-obovate: stamens deciduous: ovary stipitate.

On mountain slopes, Cornelia, Georgia. Spring.

A yellow-flowered species related to *Baptisia megacarpa*, but the leaflets are acute or acuminate at both ends and conspicuous on account of their pale nerves. The foliage is more pubescent and the flowers smaller. The lower calyx-segments are conspicuously acuminate and not obtuse or acutish as they are in *B. megacarpa.*

The type specimens were collected on the northern slope of Mount Griffin, near Cornelia, in northern Georgia, on May 1, 1897, by Mr. A. M. Huger, for whom the species is named.

BAPTISIA CUNEATA.

Perennial, glabrous. Foliage slightly discolored in drying: stems erect, 3–5 dm. tall, sparingly branched: leaves 3-foliolate: stipules lanceolate: leaflets leathery, cuneate, sometimes slightly cuneate-rhomboidal, 3–6 cm. long, often mucronulate, barely reticulated: racemes about 1 dm. long, slender, short-peduncled: pedicels slender, 1.5–2.5 cm. long: bracts lanceolate or ovate-lanceolate, acuminate, deciduous: calyx campanulate, nearly 1 cm. long; segments, except the upper one, ovate, acute: corolla pale cream-colored; standard broader than high, nearly 2 cm. broad, notched, abruptly narrowed into the claw; wings and keel petals with blades 2 mm. long.

In sand, Nueces Bay, Texas.

Related to *Baptisia bracteata* but with glabrous foliage. The broad cuneate leaflets are not known in the related species. The pedicels are much longer and the calyx-segments abruptly pointed and not acuminate as they are in *B. bracteata.* The ovary, too, is glabrous or nearly so.

The type was collected by Mr. Heller along Nueces Bay, Texas, on April 3, 1894. Number 1523.

POLYGALA LEWTONII.

Birennial. Foliage glabrous, bright green. Stem much branched at the base; branches numerous, ascending or decumbent, 1–2 dm. long, simple, sharply-angled: leaves clustered, crowded, fleshy, spatulate or linear-spatulate, 1–2 cm. long, acute or acutish, wrinkled in drying: racemes 1–5 cm. long, loosely-flowered: pedicels slender, 1–2 mm. long: sepals various, dorsal broadly oblong, anterior narrowly-oblong, both 2 mm. long, obtuse; wings deep pink, inequilateral, half-rhombic, 4.5–5.5 mm. long: corolla deep pink: petals about 4 mm. long, the keel more finely lacerate than in *P. polygama*: style from the truncate top of ovary, ascending, cucullate above the middle, tufted appendage and stigmatic gland not approximate: capsule oblong-prismatic, 5 mm. long, glabrous: cleistogamous racemes slender, few-flowered; pedicels slender, 1–1.5 cm. long, curved.

In sand, peninsular Florida.

A unique species of a low habit, related to *Polygala polygama.* It may be distinguished by its small, fleshy, clustered leaves. All the parts of the flower are diagnostic, the oblong outer sepals and the half-rhombic inner sepals are very different from the corresponding organs in *P. polygama.* In *P. Lewtonii* we find a narrowly oblong pod about thrice as long as broad, while in its relative we have a broad pod whose length only slightly exceeds the breadth. Cleistogamous flowers do not seem to be produced as freely as in the case of *P. polygama*, and the pedicels varying from 1–1.5 cm. in length have nothing similar in the latter species.

TRIADENUM LONGIFOLIA.

Perennial. Foliage deep green, glabrous: stems erect, 3–6 dm. tall, simple below the inflorescence: leaves opposite; blades oblanceolate, oblong or elliptic, thinnish, obtuse or notched at the apex, undulate, truncate or subcordate at the base, sessile: cymes terminal or axillary, few-flowered, sessile or short-peduncled; pedicels stout, 1–2 mm. long: sepals lanceolate or linear-lanceolate, 3–4 mm. long, acuminate: capsules oblong, about 1 cm. long, acute, glabrous, striate.

In low ground, Alabama and Florida. Summer.

A strongly marked species related to *Triadenum petiolata*, but with longer, thinner sessile or nearly sessile leaves, which are truncate or partially clasping at the base. The sepals are lanceolate and acuminate, as contrasted with the oblong, obtuse sepals of *T. petiolata*.

The originial label accompanying the type specimens reads as follows: "In fossis prope Summerville, Alabama, et ad fluv. Apalachicola, Florida, legit Rugel, Aug.–Oct., 1843."

PHACELIA BICKNELLII.

Annual, strigose. Stems branched at the base; branches erect or ascending, 1–3 dm. tall, commonly branching: leaves 1–4 cm. long; blades pinnatifid, the lower ones petioled, the upper sessile and somewhat clasping; segments acute: racemes many-flowered, 4–10 cm. long: pedicels about as long as the calyx at maturity: calyx bristly; segments linear, 5 mm. long, revolute: corolla pale blue, 4 mm. broad; segments oblique, irregularly toothed, pubescent without; appendages obsolete: filaments included, about as long as the tube, glabrous: capsules subglobose, 2 mm. in diameter: seeds sharply reticulated, reddish brown.

In barren soil, Tennessee. Spring.

Most closely related to *Phacelia Boykinii*. The habit of the plant especially the upper portion, is strongly suggestive of the inflorescence of *Heliotropium*, section TIARIDIUM. The calyx-segments are linear as contrasted with the oblong segments of *P. Boykinii*, while the corolla is only about one-half as large, and its segments are irregularly toothed instead of laciniate. The glabrous filaments also serve as a means of separation.

The original specimens were collected by Mr. E. P. Bicknell, near Nashville, Tennessee, in May, 1894.

PHACELIA LAXA.

Annual, sparingly hirsute. Stems branched at the base; branches spreading, 1–3 dm. long, simple or forked, slender:

leaves 2–6 cm. long; blades pinnately-lobed, the lower ones long-petioled, the upper short-petioled; lobes entire, ascending: racemes lax, few-flowered, 4–12 cm. long; pedicels spreading or recurved, much longer than the calyx at maturity: calyx sparingly bristly; segments obovate or suborbicular, 4–6 mm. long, obtuse, ciliate, variable in same calyx: corolla lilac or light blue, 1 cm. broad; segments rounded, entire, about as long as the tube; appendages present: stamens glabrous, shorter than the corolla: capsules suborbicular, hirsute near the top.

Differs from *Phacelia patuliflora* in the less dense pubescence and in the petioled few-lobed leaf-blades. Besides these differences in foliage, the short pedicels, the short obovate or suborbicular calyx-segments and the smaller corolla (1 cm.) all furnish ready means of separating *Phacelia laxa* from *P. patuliflora*.

The type specimens were collected by Mr. Heller along Nueces Bay, Texas, March 12, 1894, number 1446.

MARILAUNIDIUM TENUE.

Annual, hirsute. Stems erect, 1–1.5 dm. tall, simple below, dichotomous above, wiry: leaves opposite, blades linear or slightly broadened upward, 1.5–3 cm. long, sessile: pedicels slender, 1–3 mm. long: calyx bristly; segments linear-filiform, 4–5 mm. long, erect, acute: corolla purplish, 5–6 mm. long, much surpassing the calyx; tube funnelform, about 6 mm. long; segments suborbicular, 3–3.5 mm. broad.

In dry soil, Indian Territory and Texas. Spring.

A low and slender species somewhat resembling *Marilaunidium augustifolium* (*Nama dichotomum* Choisy, var. *augustifolium* A. Gray), but more densely pubescent and with wider spreading branches. The large corolla which is much longer than the calyx separates it from *M. augustifolium* and associates it with such plants as *M. demissum* and *M. hispidum*. The following are typical:

Texas: Corpus Christi, March 14–21, 1894, *Heller*, number 461.

Indian Territory: 1868, *Palmer*, number 194.

SCUTELLARIA OCMULGEE.

Perennial, softly pubescent. Stems erect, 4–8 dm. tall, more or less branched above, densely pubescent with short villous hairs: leaves opposite; blades ovate to suborbicular, 3–8 cm. long, obtuse or acutish, crenate, cordate, or the uppermost trunate: petioles about ½ as long as the blades: racemes panicled, leafy-bracted, 5–10 cm. long: bracts similar to the leaves but smaller: pedicels stout, 1–3 mm. long: corolla bright blue, 2 cm. long; tube short, gradually dilated; lower lip suborbicular, 6–7 mm. broad, entire; upper lip with an entire middle lobe, not reflexed.

On river banks, middle Georgia. Summer.

Related to *Scutellaria cordifolia*, but the leaf-blades are broader, more rounded and more truly crenate. In the corolla we find a shorter gradually dilated tube, an entire lower lip and an entire and straight upper lip.

The type specimens were collected by the writer on the banks of the Ocmulgee River above Macon, Georgia, in July 1895.

Scutellaria arenicola.

Perennial, pubescent with short upcurved hairs. Stems erect or ascending, simple or branched near the base; branches 2–4 dm. long, more or less branched above: leaves firm; blades ovate to elliptic, 1.5–3 cm. long, obtuse or acute, sharply or crenate serrate, lower ones truncate at the base, upper cuneate: petioles shorter than the blades: racemes 2–10 cm. long: bracts with oblong-oblanceolate or oblanceolate blades: pedicels ascending, 2–7 mm. long: corolla blue, 2–2.5 cm. long; tube gradually dilated; lower lip suborbicular, 1 cm. broad, slightly lobed, notched; upper lip usually apiculate.

In sand, peninsular Florida. Summer.

Resembling *Scutellaria integrifolia major* Chapm. but much more leafy. The texture of the leaf-blades is much firmer and the nerves prominent, while the margin is toothed to the apex, and none of the leaves entire, as in the case of its nearest relative.

The corolla furnishes characters in the entire lower lip and the merely undulate upper lip; the lower lip of *S. integrifolia major* being erose, while the upper one is manifestly lobed. I have the following specimens:

Florida: Eustis, Lake county, July 16–31, 1894, *Nash*, number 1316. Forest City, Orange county, July, 1894, *Lewton.*

Scutellaria Altamaha.

Perennial, pilose-canescent throughout, dull green. Stems erect or assurgent, 2–4 dm. tall, obtusely 4-angled, simple, strict, purplish: leaves numerous, opposite; blades ovate or elliptic, 1.5–5 cm. long, obtuse or acutish, serrate, densely punctate, sessile or nearly so, the upper surface somewhat marked with impressed nerves, the lower surface paler, marked with prominent lateral nerves: racemes rather crowded at the end of the stem: calyx campanulate, 2–5 mm. long, faintly ribbed, grandular punctate, with both lips of the same size: corolla pale blue, 1–1.3 cm. long, contracted and curved at the base, glandular-punctate and glandular-pilose, delicately nerved; lower lip suborbicular, notched at the side; upper lip much larger than the lower, nearly truncate at the apex, with an ovate segment at each side: stamens slightly surpassing the upper lip; anthers strongly bearded.

Collected by the writer along the Altamaha River swamp in Liberty county, Georgia, June 18–21, 1895.

Nearest *Scutellaria pilosa*, but more rigid in habit. The numerous firm sessile or very short-petioled leaf-blades with their comparatively finely serrate margins form a strong contrast with the sparse thin coarsely-crenate or crenate-serrate, long-petioled leaf-blades of its most closely related species. The corolla too is much smaller. In addition to these differences, the pubescence is much shorter and is more dense.

VERNONIA FLACCIDIFOLIA.

Perennial, sparingly pubescent or glabrate. Stems erect, 1–1.5 meters tall, slender branched above: leaves rather numerous; blades thin, elliptic below to linear-lanceolate above, 0.8–2 dm. long, acuminate, sharply serrate, sometimes doubly so, attenuate into short petioles: corymbs 1–2 dm. broad; branches slender: peduncles barely enlarged at the top: involucres hemispheric, 3–4 mm. high, light green: bracts ovate to oblong, obtuse, ciliate, sometimes colored at the tip, not at all spreading: pappus pale straw-color: achenes 3 mm. long, with sharp ribs upwardly barbed.

On wooded hillsides, Ringgold, Georgia.

A species of rather delicate habit related to *Vernonia ovalifolia* T. & G., but differing in its much less rigid habit, glabrate foliage and larger differently shaped leaves which are of a very thin texture. The smaller involucres with their obtuse bracts and the pale straw-colored pappus are diagnostic.

The original specimens were collected by the writer on mountain sides about Ringgold in northwestern Georgia, in August 1895.

Vernonia pulchella.

Perennial, hirsute. Stems solitary or clustered, 3–10 dm. tall, branched above: leaves firm; blades oblong-oblanceolate or oblong to nearly linear-lanceolate, 2–10 cm. long, acute, serrate, often sharply so, somewhat crisped, revolute, sessile but not at all cordate: corymbs 1–1.5 dm. broad: peduncles 1–3 cm. long, slightly enlarged upward or some heads nearly sessile: involucres campanulate, 6–7 high, often purplish: bracts lanceolate to linear-oblong, prolonged into linear-subulate spreading or recurved tips: pappus pale straw-colored: achenes 3 mm. long, with upwardly barbed ribs.

On sand hills, Georgia.

A handsome species related to *Vernonia scaberrima* Nutt. It is, however, more robust in habit and has larger serrate leaves which are destitute of the peculiar base characteristic of *Vernonia scaberrima*. The tips of the involucral bracts are more slender and less rigid than those of its relative.

The type specimens were collected by the writer on sand hills bordering the Altamaha River swamps in Liberty county, Georgia, in July 1895.

Vernonia tenuifolia.

Perennial, with thinly pubescent foliage. Stems erect, 0.5–1 m. tall, branching above: leaves numerous; blades linear or nearly so, 0.5–1.5 dm. long, acute, serrate, minutely punctate, sessile: corymbs 5–10 cm. broad, with rather few heads: peduncles slightly enlarged upward: involucres campanulate, 8–10 mm. high, purple: bracts ovate to oblong, erect, acute or mucronate: pappus straw-colored or tinged with purple: achenes about 4 mm. long, with smooth and glabrous ribs.

In dry soil, western Texas.

Although this form has been confused with *Vernonia marginata* it is abundantly distinct. Its leaves are manifestly serrate while the broader and shorter involucres with their merely acute or mucronate bracts are very different from the narrower involucres and the acuminate bracts which are characteristic of *Vernonia marginata*.

Silphium rumicifolium.

Perennial, glabrous or nearly so, bright-green. Stem erect, 4–8 dm. tall, simple below, corymbosely branched above, grooved, reddish purple, stout: leaves mainly basal; blades leathery, oblong to oblong-obovate, 1–1.5 dm. long, rounded at the apex, repand-undulate, smooth, red-nerved above: petioles shorter than the blades, winged, dilated and sheathing at the base: stem-leaves few, much reduced, narrow, serrate: pedicels stout, 5–12 cm. long, with several deciduous bracts: involucres hemispheric, 2 cm. broad: bracts various, the outer orbicular-ovate, about 1 cm. long, the inner oblong, about 1.5 cm. long, rounded: corollas 6–7 mm. long: rays yellow, 1.5–2 cm. long, notched at apex: achenes oblong-obovoid, 9–10 mm. long, narrowly winged, notched at the apex.

In dry sterile soil, Tennessee. Summer and fall.

I noticed this form as a new species in one of the larger herbaria several years ago. Prof. Ruth now sends newly prepared specimens of the same from Knoxville, Tennessee, where he collected them in September 1897, number 4024.

The new species is related to *Silphium terebinthaceum*, but the obovate type of leaf-blade with the tapering base is not characterstic of that species. A prominent character exists in the involucre where the outer bracts are broader than long, while in the most closely related species the corresponding bracts are longer than broad.

✓COREOPSIS LEWTONII.

Perennial glabrous. Stems branched at the base; branches ascending or slightly decumbent and erect, 3–5 dm. tall, slender, simple, or sparingly branched above: leaves opposite, approximate below, distant above; blades linear or narrowly linear-cuneate, 1–3 cm. long, obtuse or acutish: petioles somewhat shorter than the blades, often filiform: peduncles filiform, 1–7 cm. long: involucres 7–8 mm. broad: bracts scarious-margined, outer ovate, 1–1.5 mm. long, obtuse, inner oblong or oblong-lanceolate, 5–6 mm. long, obtuse or acutish: rays yellow, broadly cuneate, about 1 cm. long, 3-lobed; lateral lobes gradually rounded; terminal lobes notched: corolla yellow, 2 mm. long, segments recurved: style 2 mm. long, glabrous: achenes oblong to suborbicular; body elliptic, 2 mm. long; wings broad, entire; awns short.

In low sandy soil, peninsular Florida. Summer.

A species related to *Coreopsis angustifolia* but much more delicate in habit. Readily distinguished by the manifestly petioled leaf-blades, the broader and more amply lobed rays and the entire short-awned achenes.

The original specimens were collected by Mr. F. L. Lewton at Forest City, Orange County, Florida 1894.

SENECIO EARLEI. = S. Smallii Britt.

Perennial, bright green, densely cottony below, sparingly so and glabrate above. Stems usually tufted, erect or ascending, 2–5 cm. tall, simple or nearly so below, corymbosely branched above: leaves various, basal quite numerous; blades oval or oblong, 1.5–6 cm. long, serrate, obtuse or retuse, often crimson beneath: petioles longer than the blades; stem-leaves pinnatifid, linear-lanceolate or oblong, the lower ones with petioles, the upper sessile: pedicels slender: involucres hemispheric, 8–9 mm. broad, 8–10 mm. high: bracts of the involucres linear or nearly so, 5–5.5 mm. long, acute, hyaline-margined: rays oblong, 4–6 mm. long, bright yellow, corolla yellow, 4–4.5 mm. long; segments triangular or ovate: style glabrous: achenes 3 mm. long, scabro-pubescent on the angles.

In dry soil, Tennessee and Alabama. Spring and summer.

A showy species related to *Senecio tomentosus.* The main points of difference are: First, the almost wholly glabrous foliage, only the base of the plant permanently woolly. Second, the shorter petioles, and shorter, more rounded and more finely toothed leaf-blades. Third, the more open inflorescence and more numerous heads. Named for Prof. F. S. Earle, of Auburn, Alabama.

I have the following specimens:

Alabama: Auburn, Lee County, 1896, *Earle* and *Underwood.*

Tennessee: Knoxville, Knox County, 1897, *Ruth,* number 4211.

SENECIO MEMMINGERI Britton.

Perennial, glabrous or nearly so, bright green. Stems erect, solitary or tufted, 3–6 dm. tall, simple below, corymbosely branched above, accompanied by tufts of basal leaves: basal leaves 1–2 dm. long; blades bipinnatifid, longer than the petioles; segments oblong or obovate in outline, more or less cuneate at the base, coarsely toothed or incised, the teeth entire or with 1 or 2 small teeth: blades of the stem-leaves similar but usually more finely divided: corymbs 5–15 cm. broad: heads usually numerous: involucres campanulate, 6–7 mm. broad: bracts linear, the longer 5 mm. long, acute, scarious-margined: corollas 4–4.5 mm. long; segments triangular-ovate: rays yellow, linear-oblong, 5–6 mm. long, 3-toothed at the apex: achenes grooved, 1.5 mm. long, pubescent.

In dry soil or on cliffs in or near the mountains, North Carolina and Alabama. Spring and summer.

Most closely related to *Senecio Millefolium*, but clearly distinguished by the coarse leaf-segments. The original specimens of this species were collected in Henderson county, North Carolina, by Mr. E. R. Memminger, in 1887. In 1891, in company with Mr. A. A. Heller, I found the plant on Blowing Rock Mountain in northwestern North Carolina. Prof. Underwood and Prof. Earle have given me specimens almost identical with the North Carolina plants from Auburn, Lee county, Alabama, where they collected it on May 16, 1896.

✓HIERACIUM ARGYRAEUM.

Perennial, the lower parts shaggy with long hirsute hairs. Stems erect, 3–6 dm. tall, mostly simple below, corymbosely branched above, and there naked: leaves mainly near the lower part of the stem; blades oblong-oblanceolate to oblong, 2–8 cm. long, slightly apiculate, shaggy pubescent on both sides, sessile or short-petioled: corymbs mostly with 4–10 heads: peduncles slender, glandular-pilose: bracts of the involucres narrowly linear or narrowly linear-lanceolate, 8–10 mm. long, scarious-margined, acute: rays yellow: pappus silvery white: achenes spindle-shaped, 4·5 mm. long, sharply ribbed, granular.

In sandy soil, Florida. Spring.

Related to *Hieracium Gronovii*, but with a habit suggesting that of *H. Marianum*. In place of a narrow panicle we find a corymbose inflorescence. The heads are much larger than those of *H. Gronovii* as are also the involucral bracts. The achenes are much larger and surmounted by a silvery-white pappus which is longer than the tawny pappus of *H. Gronovii*.

The type specimens were collected by Mr. Geo. D. Hulst, at DeLand, Florida, in March 1891. Other Florida localities are: Tampa Bay [*Leavenworth !*]; St. Marks, May, 1843, *Rugel;* Mayport and Jacksonville, 1870–76, *Keeler.*

III.—NEW SPECIES OF WOODY PLANTS.

HYDRANGEA CINEREA.

A spreading shrub, 1–2 meters tall, with deep green foliage. Leaves opposite; blades thinnish, oval, elliptic, narrowly ovate or orbicular-ovate, 6–15 cm. long, acuminate, serrate, obtuse, rounded or cordate at the base, bright green above, gray tomentose and not reticulated beneath; petioles somewhat more than ½ as long as the blades or shorter: corymb 5–15 cm. broad, rather round topped: sterile flowers commonly present: calyx campanulate; tube ribbed; segments triangular, acute: petals 5, ovate, boat-shaped, 1.5 mm. long, hooded at the apex: stamens conspicuously exserted: capsule urn-shaped, about 2 mm. in diameter, usually higher than broad, strongly ribbed, tipped by the 2–3 spreading styles.

Western slopes of the Allegheny Mountains, Tennessee and Georgia. Spring and summer.

This shrub stands between *Hydrangea arborescens* and *H. radiata* but is distinguished from either by the gray tomentum of the lower surface of the leaves.

The following specimens belong here:

Tennessee: Chilhowee Mountains, June, *Curtiss*, Number 833; White Cliff Springs, June 24, 1890, *Scribner*, July, 1894, *Kearney*; Chilhowee Gap, Blount County, June 24, 1893, *Kearney*.

Georgia: Ringgold, August 6–12, 1895, *Small*.

PRUNUS INJUCUNDA.

A shrub or tree of a somewhat straggling habit, seldom spiny, clothed with a dull dark-gray bark which on the younger branches is covered with a fine pubescence of a velvety texture. Stem 5–8 meters high, with a maximum diameter of 2 dm.; branchlets ascending or erect, the youngest flexuous: leaves 2–6 cm. long, 1–3 cm. broad, blades oval or obovate, acute or somewhat acuminate, finely but sharply serrate (the teeth apiculate), acute or acuminate at the base, conspicuously and densely pubescent beneath, inconspicuously pubescent and slightly rugose above; midrib very prominent, its lateral branches less so: petioles .5–1 cm. long, pubescent: drupe oblong, 10–13 mm. long, dark purple, clothed with a lighter bloom: stone ovoid, 8–10 mm. long, much compressed, pointed at both ends, crested and grooved on each side of the crest, also grooved on the opposite side.

In sandy soil on the granite districts about Stone Mountain, Georgia. First collected by the writer on July 7, 1893, at the base of Little Stone Mountain.

Heretofore confused with *Prunus umbellata*; it has, however, a more rigid habit and the foliage, including the branchlets, is velvety-tomentose. In place of the subglobose drupe of *P. umbellata*, we find an oblong fruit of an extremely bitter taste. The stone is correspondingly lengthened.

IV.—A NEW GENUS OF PARONYCHIACEAE.

In that peculiarly formed and little explored region of south-western Georgia and adjacent Florida, there grows a unique plant which has posed in an unstable manner in both the genera *Paronychia* and *Siphonychia*. It is clear that Dr. Chapman, in dealing with the plant, was more or less dissatisfied with the disposition he made of it, for in one edition of his flora we find it in *Paronychia*, while in another he has assigned it to *Siphonychia*. In fact the species possesses characters sufficient to establish it as a distinct genus. A prominent character is the peculiar involucel subtending the calyx.

FORCIPELLA.*

Annual or biennial pubescent herbs. Stems erect, simple below, forking above, the ultimate divisions ending in cymes. Leaves opposite, narrow, sessile. Cymes many-flowered, rather dense. Flowers perfect, inconspicuous, 2–3 in an involucre composed of two bracts and their broad 2-parted stipules, each, or only 2 seated in a hard, clamp-like involucel, whose two lobes are notched. Calyx of 5 linear-subulate distinct (sometimes cohering at the base) sepals. Petals none. Stamens inserted about the middle of the sepals. Ovary 1-celled, sessile. Style simple, very long and slender. Utricle included, ovoid.

FORCIPELLA RUGELII (Chapm.).

Siphonychia Rugelii Chapm. Fl. S. States 47. 1860.

Paronychia Rugelii Shuttl.; Chapm. Fl. S. States, 47. As synonym. 1860.

Annual or biennial, rather slender, finely pubescent. Stem erect, 1–5 dm. tall, forking, finally diffuse: leaves thickish, oblanceolate, or the upper linear-oblanceolate, 1–3 cm. long, acute, pubescent on both sides, ciliate, sessile: bracts of the involucres linear-subulate, their stipules ovate, acutish or short-acuminate, denticulate: calyx 3 mm.

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* Diminutive of *forceps*, referring to the clamp-like involucels.

long, pubescent below the middle, erect in the whitish clamp-like involucel; sepals linear-subulate, acutish, erect, slightly involute: stamens included: style about equalling the sepals in length: utricle ovoid, tipped by the slender style: seeds lenticular, about 1 mm. broad.

In sandy soil and on sand hills, southwestern Georgia and adjacent Florida. Summer and fall. The species has been collected as follows:

Florida: Barren sandhills, October, *Chapman.*

Georgia: Bainbridge, *Chapman;* October, 1869, *Curtiss,* number 345.

A new Southwestern Rose.

By E. O. Wooton.

(Plate 335.)

The species here described and figured is particularly interesting as being the second member of a heretofore monotypic section of the genus *Rosa*—the Minutifoliae of Crepin. * While agreeing in most particulars with the characters there ascribed to this section, it can hardly be said to have appendiculate outer sepals, nor is the pubescence of the receptacle long.

While closely related to *Rosa minutifolia* Engelm., it is easily separated from that species by its less numerous and larger hips with fewer and smaller spines. The stellate trichomes, referred to in the name I have given it, are most unique and interesting in this genus.

As an addition to the known wild roses it is of especial interest on account of the size and beautiful coloring of its flowers. It seems well worthy of cultivation.

✓ Rosa stellata.

Shrub, 4–6 dm. high, much branched. Stems stiff, beset with numerous straight or slightly curved yellowish spines, young stems closely covered with stellate trichomes which may be scale-like or have a central gland-bearing axis, or this axis may be a well developed spine: leaves small, 1–2.5 cm. long, 3–5-foliolate; leaflets triangular, 5–7 mm. long and almost as broad, cuneate, apex truncate or slightly rounded, cut into 5–8 large rounded but acute teeth, one sinus frequently reaching to the middle of the leaflet; stipules oblong, 5–7 mm. long, obtuse, spreading, adnate for about half their length, entire or with 1–2 rounded teeth; leaflets, petiole and stipules covered with a fine spreading silky white pubescence, not glandular: flowers large and showy, solitary, 4–7 cm. in diameter, terminal, deep rose-purple; pedicel short, 1 cm. or less long, stout; calyx-tube globose, 6–8 mm. in diameter, very finely pubescent and covered with numerous spines: pedicel, calyx tube and spines generally purplish tinged; limb of calyx ovate-lanceolate, 1.5–2 cm. long, 5 mm. broad at base, white woolly within, persistent and connivent in fruit, generally laciniately 2–3-lobed, lobes slender, broadened at apex, entire or serrulate, glandular along the margin; petals broadly obovate, 2.5–3 cm. long, 2–2.5 cm. broad, truncate, outer margin repand; stamens numerous, 5 mm. or less long; filaments slender, glabrous; anthers versatile, elliptical, with cordate-reniform base and emarginate or retuse apex, dehiscent by marginal slits, introrse; pistils many, 5 mm. long, covered with stout fuscous hairs; ovary short-stipitate, stipe attached at one side of median line; style rather stout; stigma capitate, oblique; fruit irregularly spheroidal, spiny, 1–1.5 cm. in diameter, reddish brown; achenes numerous, oblong or elliptic cylindrical, brown, glabrous.

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* Bot. Gaz. **22**: 32. 1896.

First collected in flower near the Cueva in the Organ Mountains, New Mexico, April 30, 1893, on a dry rocky hillside at an altitude of about 5500 feet. Collected again at the same place with immature but dried up fruit July 10, 1897 (no. 126), and in the White Mountains, Lincoln County, July 22, 1897 (no. 193), two miles west of the Mescalero Agency at an altitude of about 6000 feet. A single specimen collected in August, 1897, on the Fresnal in the Sacramento Mountains, N. M., at an altitude of something over 6000 feet was kindly given to me by Miss M. C. Eaton, of Roswell, New Mexico, who told me that it was very abundant where she had found it, often forming large patches acres in extent and producing a beautiful appearance.

There is some considerable variation in the specimens collected at the different localities, those from the higher altitudes being more vigorous (generally 10–12 dm. high, with larger leaves), more glandular, more spiny and less pubescent. The description above applies to the plant first collected except in the fruit. Specimens with ripe fruit from this locality I have not seen, but I have here described the fruit of White Mountain plants.

The Organ Mountain specimens are closely lepidote on all the branches of the year and these trichomes, which are not usually spiny, persist on branches that are two years old. The leaves are as described, finely pubescent and not at all glandular, and the leaflets perfectly triangular. Specimens from the White Mountains show all grades of stellate scaliness from closely so on the branches of the year, to only slightly so immediately below the flowering peduncles. Old stems are rarely lepidote and all are much more spiny, the stellate trichomes being replaced by numerous fine recurved spines. The leaflets of these specimens vary from triangular to obovate, and from finely pubescent to perfectly glabrous. The teeth are generally more numerous and the margin is more or less supplied with sessile glands.

The Fresnal specimen is perfectly glabrous on leaves and stems, but the stems are very spiny and bear numerous stipitate glands, while the margins of the leaflets and stipules are very glandular; the leaflets are usually five in number and obovate. The absence of stellate trichomes, the more numerous spines, the generally more numerous, larger, and differently shaped leaflets, and the glandular character of this plant would seem to be sufficient to establish a well marked variety at least, but the material examined seems to me to be too scanty to warrant such action.

Explanation of Plate 335.

Rosa stellata Wooton.

FIG. 1. Branch showing bud and flower, natural size. Organ Mountains.
FIG. 2. Young growing branch, natural size. Organ Mountains.
FIG. 3. Single leaf, natural size. Organ Mountains.
FIG. 4. Section of flower, natural size. Organ Mountains.
FIG. 5. Stamen and pistil, × 4. Organ Mountains.
FIG. 6. Leaf and spine, natural size. White Mountains.
FIG. 7. Fruit, natural size. White Mountains.
FIG. 8. Achenes, × 2. White Mountains.
FIG. 9. Three forms of trichomes, magnified.

Three Editions of Marcy's Report on the Red River of Louisiana.

By Frederick V. Coville.

My attention has been recently called by Mr. J. W. Blankinship to the fact that there are in existence three editions of Captain Randolph B. Marcy's report entitled "Exploration of the Red River of Louisiana in the year 1852."

Of the three editions one was published in the year 1853 as Senate Executive Document No. 54, 32d Congress, Second Session. Both the other two editions were published in 1854, one as a Senate Executive Document, without number, 33d Congress, First Session, the other as a House Executive Document, without number, 33d Congress, First Session. For convenience these editions may be referred to repectively as Senate, 1853; Senate, 1854; and House, 1854.

All three editions contain Captain Marcy's own report followed by eight appendices of which the seventh, appendix G, consists of the botany of the expedition by Dr. John Torrey. Plates numbered from 1 to 20 accompany the botanical report and in all three editions plate 18, which, according to the explanation of plates, should be *Abronia cycloptera*, is missing. There is nothing in the text of any of the editions to suggest the reason for this omission; for though *Abronia cycloptera* is not mentioned in the body of the appendix the same is true of *Geranium Fremontii*, *Xanthisma Texanum*, and *Heliotropium tenellum*, all of which, however, are figured.

The Senate 1853 edition is clearly, as its date and its sequence in the Executive Documents would indicate, the one first published, the publisher according to the title page being Robert Armstrong. The plates accompanying the botanical report were lithographed by Ackerman of New York, as was also the principal map accompanying the report. The botanical appendix, exclusive of its half title and Dr. Torrey's letter of transmittal, begins on page 280 and extends to page 302, followed by an explanation of the plates.

The House 1854 edition, which probably appeared before the Senate 1854 edition, bears on the title page the name A. O. P. Nicholson, as the publisher, while the lithograph plates of the botanical appendix, as well as the map, were made by Lawrence, of New York. The main part of the narrative is set up in type of precisely the same size as that used in the Senate 1853 edition, but it is clear from the lack of uniformity in broken letters, an occasional letter from a wrong font, and a running forward or backward of single words or single lines that the matter was all reset. The pagination however, as far as page 117, the end of Captain Marcy's own report, is the same. Beginning with page 118 the meteorological tables, etc., were set up in different type so that a conspicuous difference in the pagination follows. Dr. Torrey's botanical appendix, exclusive of the introductory matter, begins on page 248 and extends to page 270, followed, as in the other edition, by the explanation of plates. It is clear that the copy used in setting up this second edition was not the original manuscript, but consisted of the printed pages of the earlier edition. For practical purposes all citations of the botanical portions of the two are identical with the exception that in the House 1854 edition the corresponding pages are numbered 32 less than in the Senate 1853 edition, page 280 corresponding to page 248, and so on throughout. The lithograph plates of the House 1854 edition are perhaps slightly inferior to those of the 1853 edition.

The Senate 1854 edition differs somewhat more from the other two, but the differences are almost wholly typographical. The publisher, according to the title page, was Beverly Tucker. The botanical lithographs and the map, as in the Senate 1853 edition, bear the name of Ackerman. Captain Marcy's narrative is set up in larger type than either of the earlier editions and occupies about ten pages more. The botanical appendix is set up, on the other hand, in smaller type than in either of the other editions and extends, exclusive of introductory and supplementary matter, from pages 267 to 289. In general the corresponding pages contain the same matter as in the other editions, but in a few cases from one to several lines are run backward or forward upon the adjacent pages. From the internal evidence furnished by occasional typographical differences it is clear that the printed pages of one of the other reports, probably the House 1854 edition, was used as printers' copy.

The differences in the botanical appendices in the three editions are such as would be made by a typographer or a non-botanical proof-reader. It is evident that proof of the two later editions did not go through Dr. Torrey's hands. For purposes of consultation, so far as the subject matter is concerned, therefore, any one of these editions is equally valuable, the only difference of importance being that of pagination. Fortunately it is the true first edition, that is, the Senate 1853 edition, which has usually been cited in botanical publications, including the Botany of the Mexican Boundary Survey, Gray's Synoptical Flora, Watson's Bibliographical Index, and the Index Kewensis. Indeed, I have seen no published citations from either of the two later editions.

This report is a good illustration of the wasteful methods pursued in the publication of government reports before the establishment of the present Government Printing Office. The three editions of this report were published by as many different firms, the type was set up three times, and the government therefore paid thrice the normal cost of composition work. Under the present system the printing of all three editions would have been done under one roof, and electrotypes would have been used for the two later editions, thus reducing the cost of composition by two-thirds.

Mycological Notes.

By Byron D. Halsted.

The Checking of Hollyhock Rust.—There was rejoicing in the Plant Hospital over one fungus that appeared there late in autumn for the first time. For two years it has been watched for and the plants treated to sprayings in anticipation of its advent.

The year 1889 may be set down as the time when the hollyhock rust (*Puccinia malvaceavum* Mont.) made its appearance in a general manner in the United States. This is one year in advance of the outbreak of the carnation rust (*Uromyces caryophyllinus* Schr.) which came generally to the notice of the florists in 1890, and has remained as a serious menace ever since. In like manner 1896 is the year in which the asparagus rust (*Puccinia asparagi* DC.) came to us in a violent form and without any abatement during the past year. All three of these genuine rusts had been previously known in Europe for a long time, and came to us in a way that is not yet not fully understood.

But to return to the hollyhocks, it may be written that a row of plants were grown from seed and when three months old were set in the experiment area, and certain ones sprayed and others not, all through the growing season of 1896 without a single sorus of the rust appearing upon any plant either check or sprayed.

In passing it may be recorded that there was a large amount of the leaf spot (*Cercospora althaeina* Sacc.) and reward for the treatment was ample, for the fungicides worked admirably and kept the sprayed plants comparatively clean. During 1897 similar results were obtained for the fungicides with the *Cercospora*, but, best of all, the enemy for which the plants were set to catch appeared in October. It is worthy of remark that it came no earlier than this, the plants being closely watched. When first discovered the sori were quite young, but they increased rapidly in number, and soon became mature. The chief fact to be here recorded and to which all that has preceded is somewhat introductory is, that of the eighteen plants that were sprayed only one showed the rust at all, while all of the untreated plants were more or less badly rusted. Here is an instance where spraying proved very effective against such a rapidly developing and deeply seated enemy as the hollyhock rust. The sprayings were made at intervals of about ten days varying somewhat and depending upon the weather.

Observation in Wind-infection of a Rust.—An instructive instance of one-sided infection was observed the past season in connection with the asparagus rust (*Puccinia asparagi* DC.). On September sixth, while inspecting asparagus fields in Gloucester County, New Jersey, the writer came to a field with quite an unusual green appearance, nearly all the fields being brown and lifeless so far as the brush was concerned, having been killed by the remarkable ravages of the rust fungus. The field in question had been cut over and the very rusty brush removed about five weeks before, with the hope that the new growth might escape the ravages of the *Puccinia*. At the date of the inspection the brush was about hip high and showing the rust only upon one side of each plant. So strikingly one-sided was the output of the rust sori that one could scarcely fail to observe it. Every main stem was almost completely covered with the rust upon one side, while the opposite bore almost no spots. It was also noticed that this rusted side varied somewhat at different ends of the long field, and at all points was at right angles to lines drawn from an old and very badly rusted bed of asparagus that stood with its end toward the broad side of the field in question and about forty rods away.

This observation teaches something concerning the rapidity of the development of the rust fungus. As the brush must needs have been developed to some extent before the uredospores could have alighted upon them, and also it is fair to judge that many of the sori upon the plants were fully ten days old, and, therefore not more than two weeks might have elapsed from the time when the spores came to the asparagus plants to that when sori were giving off their spores. The season was unusual, July being a very rainy month, and the long wet spell continued into August, followed by hot, moist weather particularly favorable for the development of fungi.

That the source of infection was the old asparagus bed is beyond question. About midway between the two beds stands a house and a few trees around it, and it was observed that there was less rust upon that portion of the new bed that was in line with this house and the old bed. In short, there was a barrier between the old bed and the new that interfered with the free passage of the spores. When the surface of the rusted stems of the old bed were dry and the winds blew from it towards the new bed, the spores were doubtless carried in great abundance, and these spores alighting upon the tender stems of the young shoots, encouraged by hot dewy nights, quickly germinated and rusted the plants. There is no reason to doubt that some of the rust spores were carried by the winds to long distances and infected plants miles from where they were produced.

A close Relation between Rainfall and Potato Rot.—The year 1897 had its counterpart in that of 1889. During the past ten years there have been in the Eastern States two Julys noted for their excess of rainfall as shown in the following averages of rainfall for New Jersey during the past ten years:

Year	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	Average
Rainfall	3.50	**10.19**	5.62	5.30	4.03	2.72	1.66	4.24	5.50	**11.42**	5.42

It is seen that in July, 1889, there was nearly double the average rainfall, and this amount was exceeded during the same month of last year.

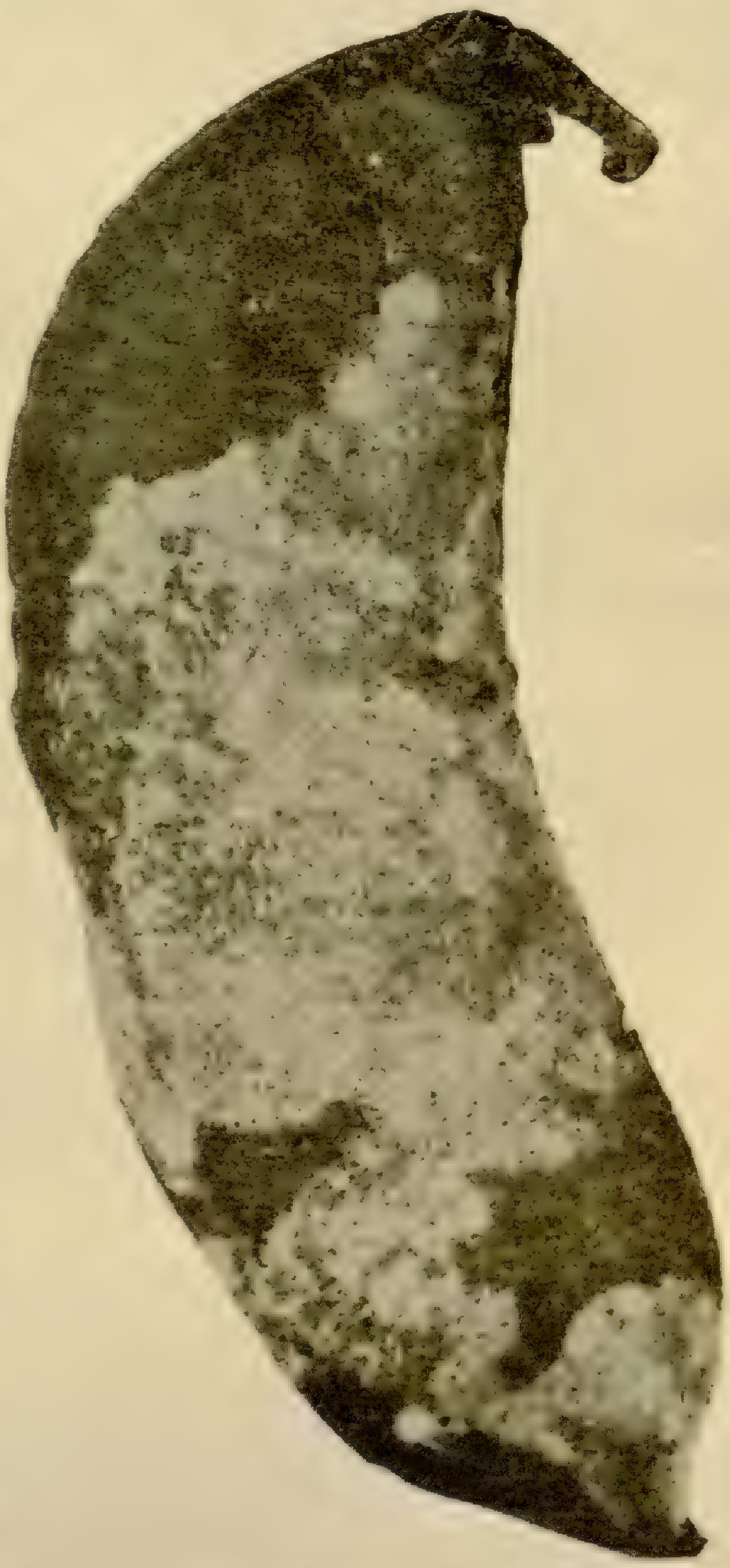
In 1889 there was an unusual outbreak of potato rot, and both *Phytophthora infestans* D.By., and the bacterial disease working alone or together carried off a large portion of the potato crop. Large growers throughout whole sections of the country did not harvest their potatoes at all. Others dug them and after they were placed in heaps the rot worked their complete destruction.

Similar results have obtained in the potato fields the past year, and the writer recalls visiting some of the leading potato growing regions, only to review the scenes of 1889 and listen to the same story of heavy rains and destructive decay.

There have been seven Julys since 1889 that were either normal or comparatively dry, and during that time potato growers have not complained of the rot. I do not remember of finding *Phytophthora* at all destructive during the period from 1889 to 1897; but the last season it was so abundant upon the experiment plots that the crop of potatoes was harvested unusually early to make sure of results in other directions. Nearly every leaf upon every plant showed first the frosty coating followed in a day or two with the wilting of the leaves.

It seems to me that the *Phytophthora* or late blight is quite dependent upon an abundance of moisture in midsummer, and if this relation is noted sufficiently the time may come, it may be predicted with reasonable certainty, that a wet July will mean a decaying potato crop, unless some successful method of checking this rapidly developing fungus is employed, and, contrariwise, a dry midsummer will insure freedom from its ravages.

The Phytophthora of Lima Beans.—In connection with what has been said above concerning the influence of copious rainfall upon the unusual development of the potato rot fungus it is in order to report that another member of the genus *Phytophthora* has been complained of bitterly during the season of 1897. The mildew of the lima beans, *Phytophthora phaseoli* Thax., is a comparatively new one, having been described by Dr. Thaxter only eight years ago* and figured in the Annual Report of the Con-



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* Botanical Gazette, 14: 273. N. 1889.

necticut Experiment Station for 1889, when it is stated that it was first noticed in September of that year, and in some cases a large portion of the crop was destroyed.

Particular emphasis is placed upon the date of the discovery and the fact that it was very abundant at the time it was taken, because that was the year in which the three months of July, August and September gave a total rainfall of 2.733 inches for New Jersey, and presumably as wet in Connecticut, which is 9.54 inches more than the average of those three months for the past ten years. Since 1889 the *Phytophthora* has been scarcely heard of until the present season when it has been as above stated so prevalent in some fields as to ruin the crop.

A fair sample of a diseased pod is shown in the engraving where the enlargement is double the normal size of all the parts. The mildew has a particular fondness for the pods and will attack them soon after flowering; in fact it was not difficult to find the whole inflorescence covered with the conidiophores before the first flower had come into bloom. The engraving shows also the general habit of the *Phytophthora* upon pods of two inches in length, in that it frequently makes its attack near the middle of the dorsal margin, and from there spreads over the pod towards the end and ventral suture and makes its densest growth of hyphae over the young seeds from which the needed nourishment is doubtless extracted abundantly.

December 15, 1897.

Proceedings of the Club.

WEDNESDAY EVENING, NOVEMBER 24, 1897.

President Brown presided, and 11 persons were present.

The first paper of the evening was by Mr. Marshall A. Howe, "The Genus *Anthoceros* in North America," and was illustrated by drawings and specimens. The paper which will soon appear in print, described three new species and reviewed the species before recognized of which latter two only occur in the Gray's Manual region, *A. laevis* and *A. punctatus*. Mr. Howe also indicated the intermediate position of *Anthoceros* between the Hepaticae and Musci, and discussed its increased sporophyte-development, looking upward toward the Pteridophyta. The life-history of *Anthoceros* was illustrated by figures, beginning with the roughened yellow or blackish spore.

By C. F. Austin, the cognate genus *Notothylas* was united with *Anthoceros*; but it lacks stomata and differs in its capsule form, direction and position. Austin's herbarium was sold in England, and now belongs in part to the bryologist Pearson, and in part to the Owens College, Manchester.

Discussion by President Brown and others followed. Dr. Underwood remarked that he had known *Notothylas* spores, unlike those of *Anthoceros*, to germinate without resting-period. *Anthoceros laevis* he finds among the hemlocks at the Botanical Garden, and elsewhere in moist, flat, sandy and grassy land, fruiting August to November. In California, said Mr. Howe, they occur on banks and in springy places, beginning to fruit in February and shrivelling in May. One of the species of the Californian coast formerly confused with the *A. caespiticius* of De Notaris, is found by Mr. Howe to develop curious globose storage-bodies, serving as food reservoirs to carry the plant over the dry seoson.

The second communication was by Dr. T. F. Allen, entitled "Contributions to the Japanese Characeae," composed in fact of four papers, soon to be printed, descriptive mainly of certain Japanese *Nitella*-forms displaying interesting correspondences with our own. Dr. Allen then proceeded to exhibit numerous mounted specimens and etchings, and spoke of the taxonomic characters. Spore-characters though important are not to be relied on exclusively. Measurements of any one species prove very constant. In some the form of the mucro terminating each ray is decisive. The spores afford specific characters both by their arrangement and their markings, as shown by a $\frac{1}{12}$ or $\frac{1}{15}$ immersion lens. Their reticulations are very constant. The spirals which invest the spores are very early formed, from the five bracts which form a cup about it and soon become spirally twisted, as all parts of the Characeae do, and as the protoplasm current does even before its cell has becomes twisted. Discussing their life-history, Dr. Allen said that the Characeae increase in part by nutrition dependent on absorption of their radicles. If these short unicellular radicles are broken in collecting, the plant will finally die after the lower cells have yielded up their contents toward the maintenance of the others. *Chara coronata*, the finest of all in showing circulation, survived in his aquarium half a year without any rooting. *Nitella flexilis* will, however, root in the aquarium, produce spores, germinate and make a protonema which divides immediately into an upward ray-bearing axis and a descending root-bearing portion.

TUESDAY EVENING, DECEMBER 14, 1897.

President Brown in the chair, and 15 persons present.

The Secretary read the reply of the Board of Trustees of the College of Pharmacy to his letter of October 28, 1897, requesting for the Club the privilege of holding its meetings at that College. The reply, dated December 3, 1897, stated that "by a unanimous vote of the Board your request for the use of our rooms for meeting purposes was granted." Thos. J. MacMahan, Chairman of Curators.

Mr. Charles J. Saunders, of Philadelphia, Pa., was elected an active member.

Dr. Britton proposed to amend Section III. of the Constitution by the substitution of the word "seven" for the word "five" in line 4, so as to read, "Associated Editors not to exceed seven in number."

President Brown appointed a special committee to consider this proposed amendment Dr. Britton, Dr. Underwood, Dr. Rusby and the Secretary.

Judge Brown announced the members of the Committee on Program for 1898 as follows: Dr. Rusby, Mrs. Britton, Dr. C. C. Curtis.

The first paper, by Prof. Francis E. Lloyd, "On an Abnormal Cone of *Pseudotsuga mucronata*," discussed the structure of a cone recently observed on a leader of the Douglas Spruce. He figured and described certain lateral expansions of the bracts, remarking on their possible stipular nature.

Remarks were made by Judge Brown, Dr. Britton, Dr. Rusby, Mr. Howe and Dr. Underwood.

The second paper, by Mr. E. O. Wooton, "Botanizing in New Mexico during the Summer of 1897," gave an entertaining and graphic narrative of this collecting trip made by Mr. and Mrs. E. O. Wooton in Doña Ana and Lincoln Counties, N. M., in last June, July and August. The route extended from the Rio Grande valley at Mesilla near the Mexican line, at an elevation of 3900 feet, to Sierra Blanca Peak, at 11000 feet. Special interest attached to the collections made from the southern end of the White Sands, a region about 30×6 miles or more in area, not before explored by a botanist, except that a half dozen plants had been gathered on its margin by Prof. T. D. A. Cockerell, of Mesilla. This vast expanse of sand, seeming like a sea of white, is moving slowly to the east. Even its lizards are white. Several new grasses were obtained here, and other very peculiar species. Very extensive collections were made in this trip, though with great hindrance from the summer rains.

Discussion brought out the great dissimilarity existing between neighboring floras in New Mexico. Mr. Wooton's collections numbered about 600 species. Mr. A. A. Heller, collecting meanwhile about 250 miles northward, among 300 numbers had but about 50 duplicates of these, and Dr. Rusby collecting some time ago at a similar distance west, among 450 species duplicated only about the same number.

ANNUAL MEETING, JANUARY 10, 1898.

President Rusby presided, and there were 22 persons present.

The favorable report of the committee to consider an amendment to the Constitution followed. The Secretary announced the change proposed, viz. to substitute "seven" for "five" in line 4 of Article 3 of the Constitution; thus increasing the number of associate editors from five to seven.

The annual reports of the officers and of the standing committees were tendered as follows:

The Treasurer, Mr. Ogden, reported a cash balance on hand of $116.93 in the general fund and $532.28 in the Buchanan fund.

The Recording Secretary, Prof. Burgess, reported an average attendance of 35 at the 15 meetings held during the year, one death, a present active membership of 213, corresponding membership 153, honorary membership 4, total 370. The 30 scientific papers presented have included many taxonomic subjects, and a good proportion of physiological, cryptogamic and morphological topics.

The Editor, Dr. Britton, reported the regular monthly publication of the BULLETIN, including 592 pages, 33 plates and one portrait; and the publication of Vol. 6, No. 2 of the *Memoirs*, containing 80 pages; issued July 30, 1897. The Editor also reported a cash balance remaining to the credit of the BULLETIN.

The Curator, Miss Ingersoll, reported valuable additions to the herbarium from Ulster county, and exhibited a completed list of desiderata prepared in accordance with the resolution of the Club of January 12, 1897.

Dr. Small reported for the field Committee, that field meetings were arranged for every Saturday from April 24 to October 30, and also on election day; 29 excursions in all. These were usually half-day excursions, with four for the whole day, and four of two days each. They have extended into the neighboring mainland of New York, into Long Island, Staten Island, New Jersey and Pennsylvania. The average attendance upon the excursions was about 16, and the average number of plants specially recorded 48.

Dr. Rusby, in behalf of the Committee on Program, announced arrangements in progress relative to presentation of several interesting topics before the Club by botanists from other cities.

One active member, Dr. C. O. Townsend, and one corresponding member, Dr. Arthur M. Edwards, were elected.

Next followed the annual election, resulting in the reëlection of the previous officers with the exception of the editor, treasurer and librarian, who declined reëlection. L. M. Underwood was elected editor; F. E. Lloyd and C. C. Curtis, associate editors; M. L. Delafield, jr., treasurer, and P. A. Rydberg, librarian. The remainder of the meeting was devoted to the presentation of miscellaneous notes.

Professor Lloyd spoke of the work of Professor L. H. Bailey upon the origin of the cultivated strawberry and tomato, and exhibited specimens to indicate that *Fragaria Chilensis* is the source of the cultivated strawberry. He also exhibited the original specimen of the strawberry known as the Hovey, and a series of specimens indicating the development of varieties of the tomato.

Dr. Rusby spoke of his experience with the *Fragaria Chilensis* as cultivated in the Bolivian Andes, where, at 10,000 feet altitude its growth is luxuriant, standing up nearly to the knees. Its fruit is large and juicy, does not keep well, and is without flavor or fragrance. Its identity with the coast form was questioned by Dr. Britton.

Dr. Rusby also exhibited a sample of *Fragaria Mexicana* by some identified with *F. Chilensis* and by others with *F. vesca*, but which keeps well and is highly flavored.

EDWARD S. BURGESS,
Secretary.

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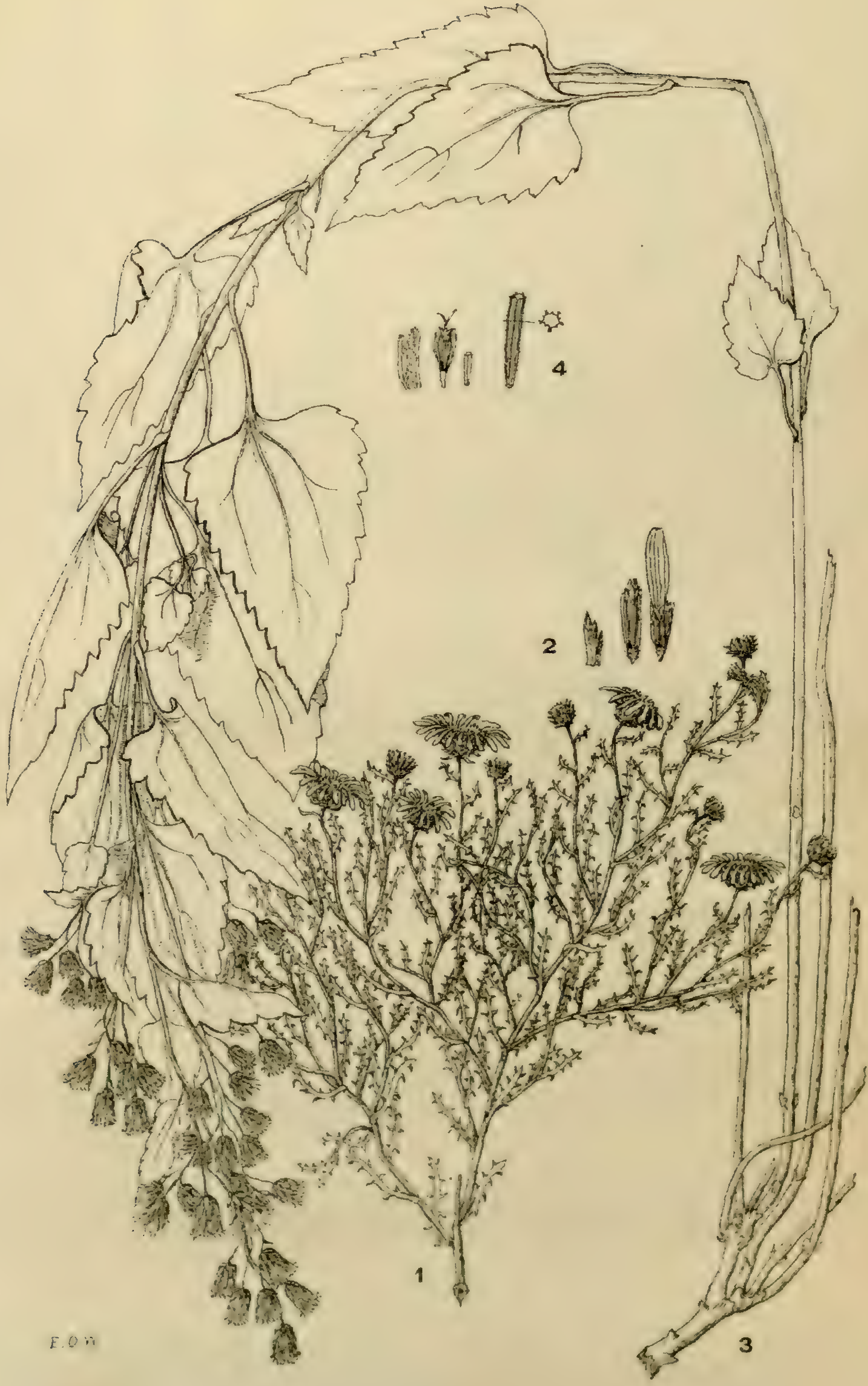

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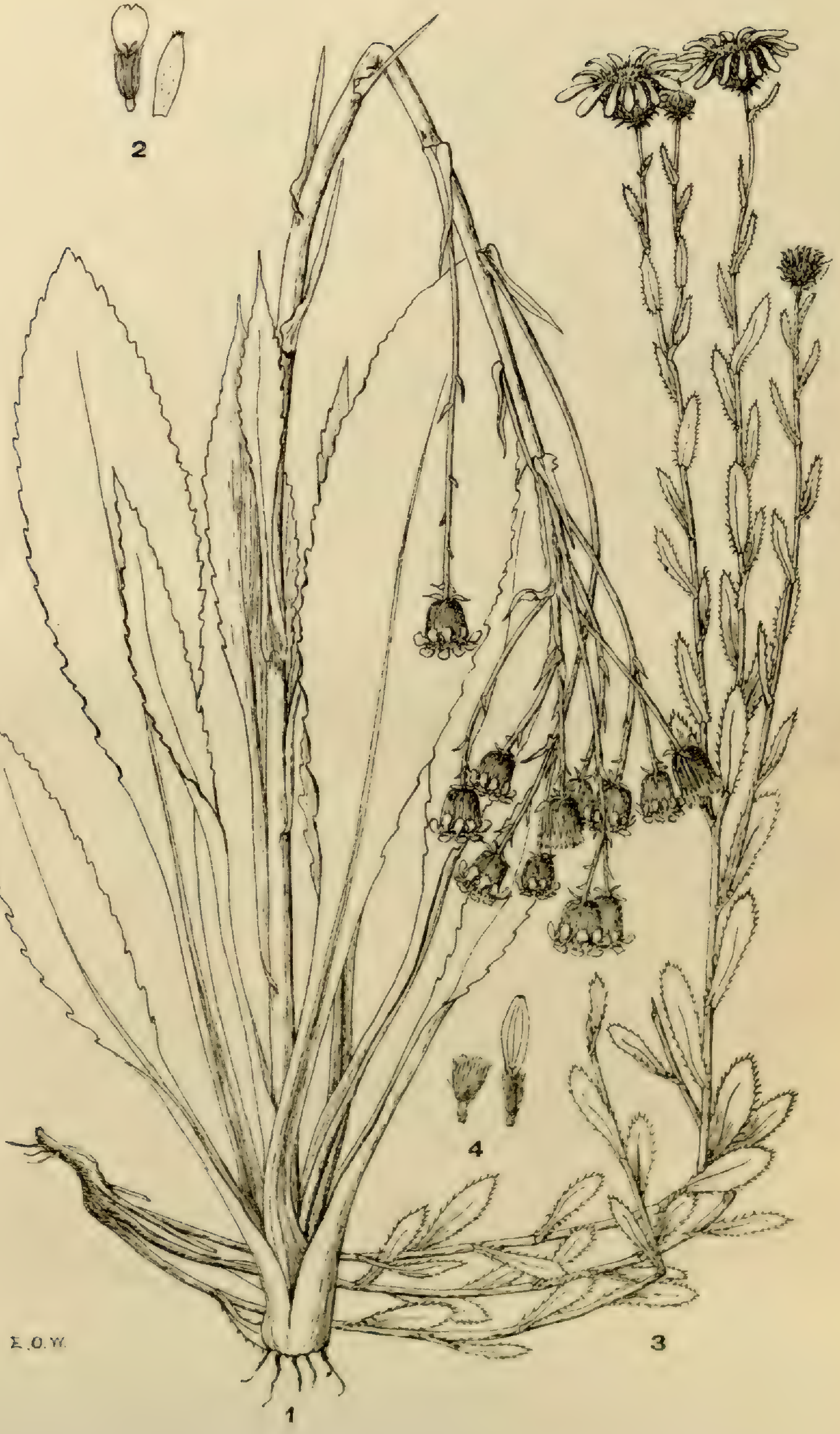
3, 4. COLEOSANTHUS AMBIGENS Greene.



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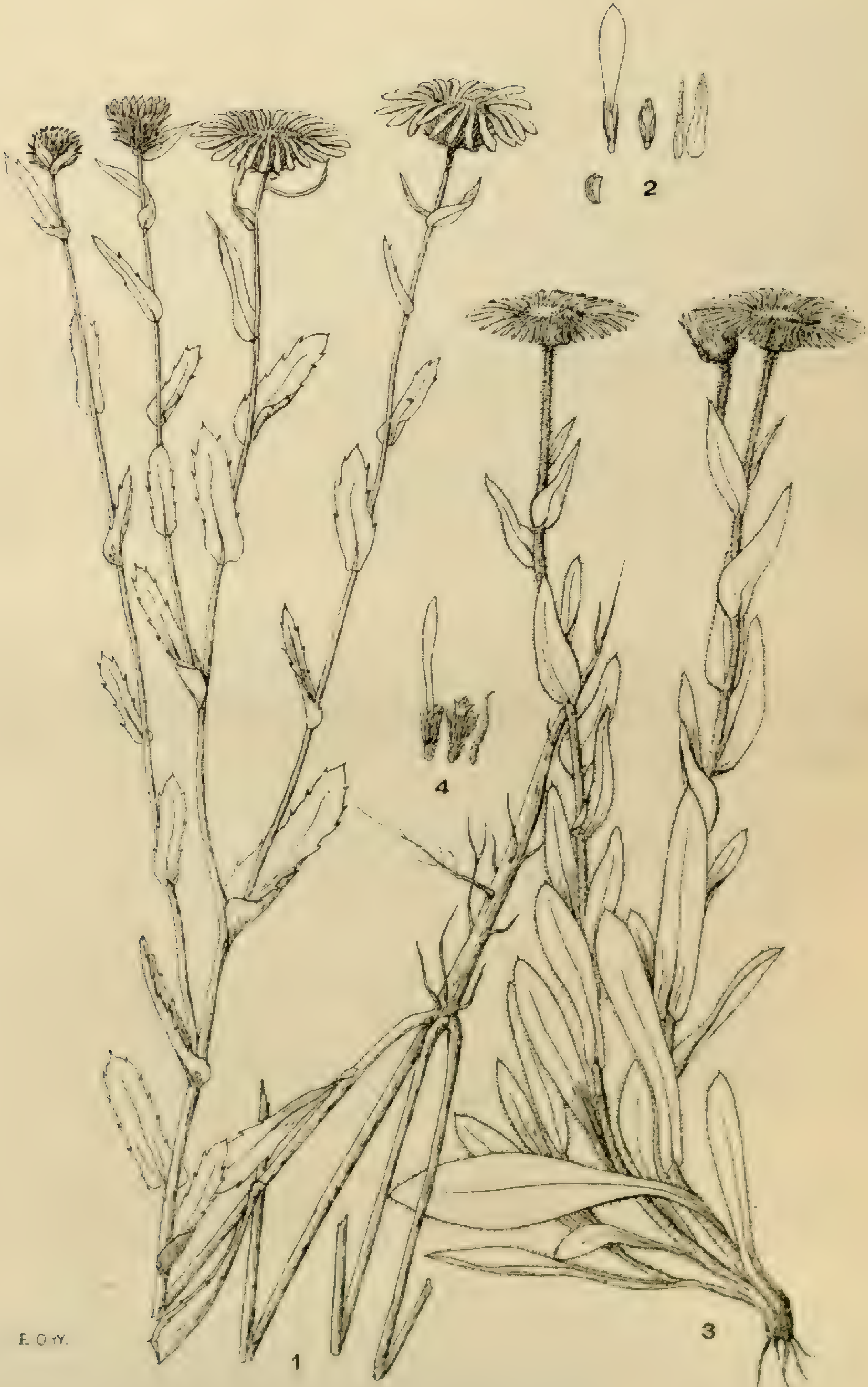

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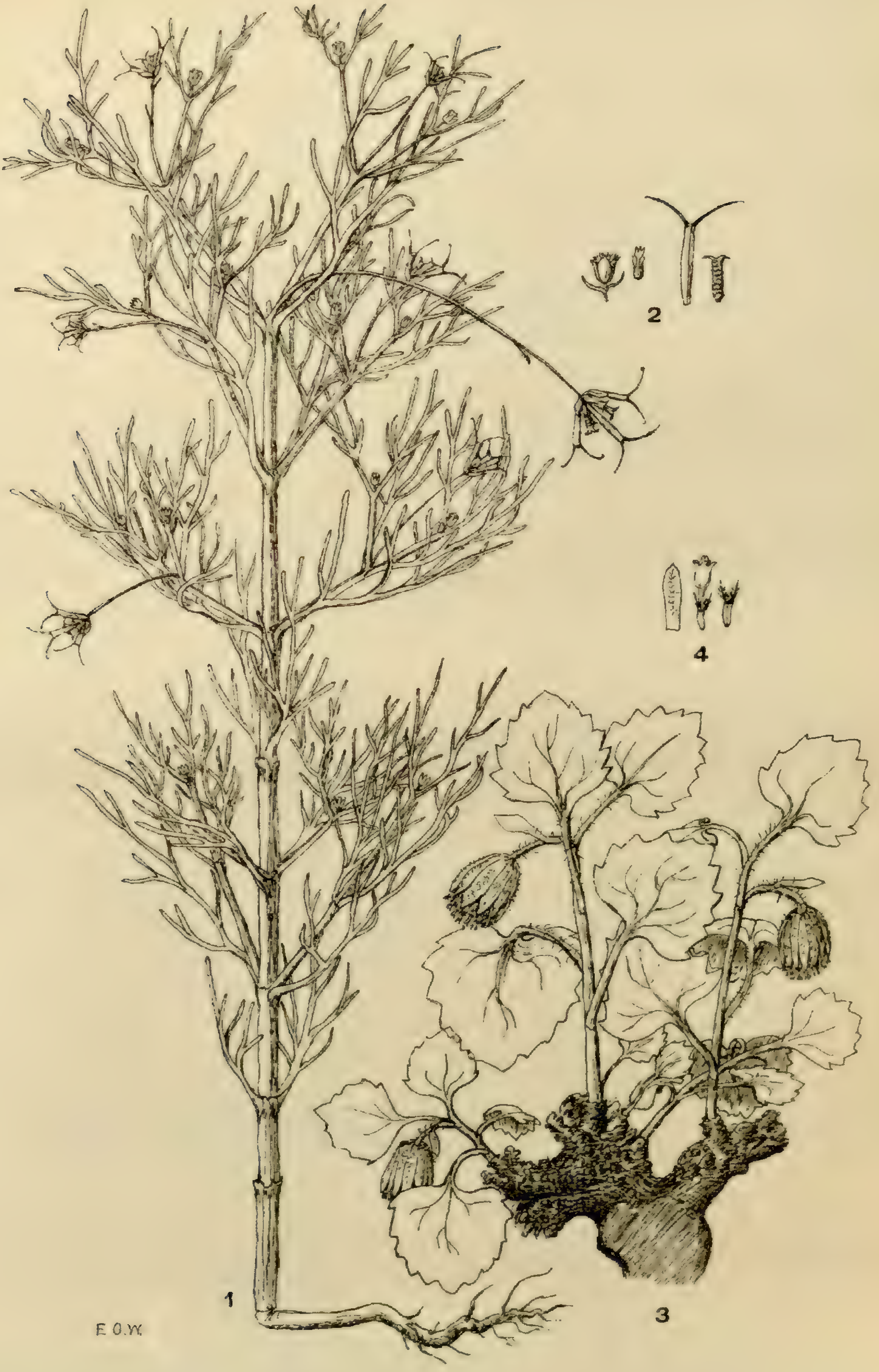
3, 4. ERIGERON FORMOSISSIMUS Greene.



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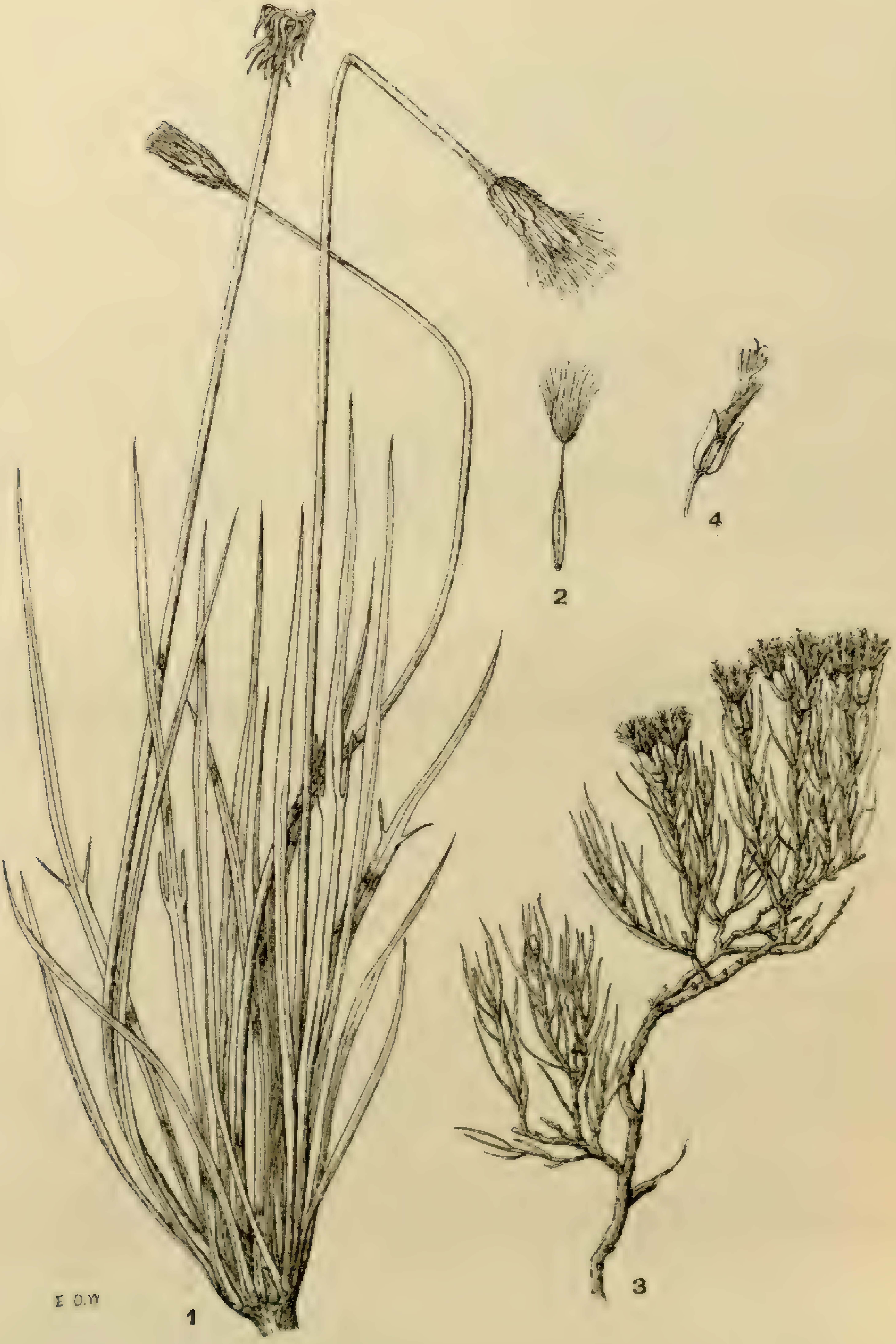
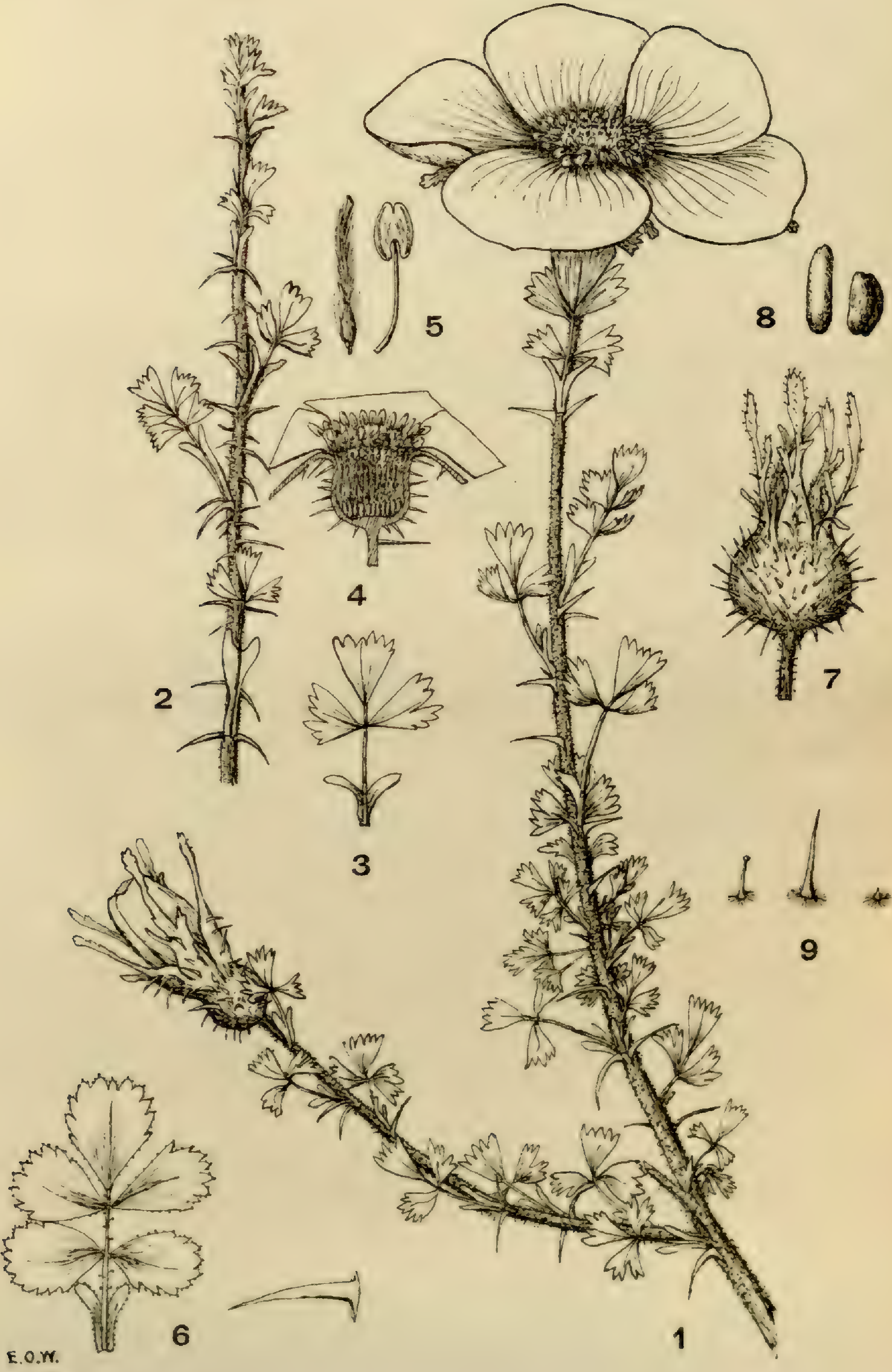
3, 4. LAPHAMIA CERNUA Greene.



1, 2. AGOSERIS GRAMINIFOLIA Greene.
3, 4. TETRADYMIA FILIFOLIA Greene.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E.O.W.

ROSA STELLATA Wooton.

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VOL. 25 No. 4

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OF THE

TORREY BOTANICAL CLUB

APRIL 1898

Studies in the Asclepiadaceae.—III.

BY ANNA MURRAY VAIL.

I.—DESCRIPTIONS OF NEW SPECIES.

ASCLEPIAS SCAPOSA.

Minutely rough-puberulent with short, often curved hairs. Stems 1–several from the same fusiform tuberous root, apparently simple, 3–4 cm. high: leaves opposite, crowded, 3–4.5 cm. long; blades oblong-lanceolate, acutish at each end, sessile, coriaceous, pubescent with short scattered roughish hairs: peduncles solitary, terminal, 6–7 cm. long, about twice longer than the stem, terete, pubescent with spreading whitish hairs; pedicels 2 cm. long: follicels erect on recurved pedicels, 6 cm. long, linear-fusiform, pubescent. Flowers and seeds not seen.

New Mexico, near Santa Rita, Wright, 1851–52; mounted with no. 1684 in Herb. Columbia University and on the same sheet with no. 1683 in Herb. Gray.

In general aspect and foliage bearing a close resemblance to some of the species of Dr. Greene's new genus *Podostemma*, but differing from them by the very long, solitary, terminal peduncle. The discovery of the flowers may prove it to belong to that genus.

ASCLEPIAS PALMERI.

Cinereous-tomentulose up to the inflorescence. Stems several from the same root: internodes about the length of the leaves: leaves opposite, 1–3 cm. long, 2 mm. wide; blades linear, acumi-

[Issued 12 April.]

nate, coriaceous; margins revolute and twisted when dry: peduncles terminal, solitary or two, 4–10-flowered, 2–5 cm. long; pedicels 1.5 cm. long, filiform: corolla-segments oblong-lanceolate, acutish, 5 mm. long, dull purplish, or ash-colored, scarious margined; column distinct; hoods whitish, tinged with pink, about 2 mm. high, not exceeding the anthers, 5-dentate at the apex; central tooth and the two ventral infolded and acute intermediate ones rounded; horn arising from the base of the hood and leaving the middle tooth of the hood free; anther-wings small, salient and angled at the somewhat rounded base, or possibly obscurely notched: follicles erect on deflexed pedicels. Mature fruit not seen.

San Luis Potosi, Mexico, Parry & Palmer, no. 583, 1878.

Clearly a distinct species and very closely related to both *A. quinquedentata* and *A. Schaffneri* and seemingly intermediate between them. The leaves are, however, much shorter, there are fewer of them, and they are cinereous tomentulose with short, twisted, whitish hairs.

I have just received from Miss Alice Eastwood, the following description of an interesting *Asclepias* from Utah:

ASCLEPIAS MACROSPERMA Eastwood.

Asclepias involucrata var. *tomentosa*, Eastwood, Zoe., **4**: 129. 1893. Not *Asclepias tomentosa* Ell. 1817.

Stems several from a woody, horizontal rootstock, slender, decumbent, 6 cm. to 3 dm. long, tomentulose, angled. Leaves alternate, close together or scattered, 1–7 cm. long, 6 mm. to 2 cm. wide; blades lanceolate, ovate-lanceolate and the lowest orbicular; base subcordate, truncate or obtuse; apex acuminate; margin undulate, densely tomentulose; upper surface of leaves glabrous except for a few hairs on the veins, wrinkled; lower prominently veined, tomentulose: umbels one or two, terminal and lateral, closely sessile, many-flowered, with involucral leaves: pedicels about 1 cm. long, filiform, tomentulose: calyx-segments ovate-acuminate, 2½ mm. long, glabrous above, tomentulose below; corolla-segments 4–8 mm. long, 3 mm. wide, reflexed, membranously margined, with a notch in the margin and the solid portion of the leaf acute, thickened, rugulose and purplish below, puberulent and greenish above; column short but distinct; hoods erect, scarcely exceeding the anthers, rounded at the subtruncate summit, the ventral margins convolute; horn falcate, subulate, inflexed, slightly exserted over the anthers: anther-wings salient below the middle, truncately rounded to the base, entire or minutely notched: follicles 6 cm. long, erect on recurved pedicels, 2 cm. long, obliquely ovate-acuminate, tomentulose, parallel-veined, tinged with reddish purple: seeds 13 mm. long, 1 cm. wide, broadly obovate, body light brown, marked with irregularly broken ridges converging to the axis; border 2 mm. wide, tan-colored, corrugated-rugose; coma 2 cm. long, copious.

Utah: Court House Wash, May, 1892; Willow Creek, San Juan Co., July, 1895.

Differing from *A. involucrata* in its larger size and stouter habit; broader, longer, and more coriaceous leaves, and much larger follicles and seeds. The differences in the horns and anthers are shown in the figures. The dorsal angle of the hood is more pronounced in *A. involucrata* and thicker. These two species are closely related; but since the differences appear to run through all parts and the vegetative distinctions are readily recognized, it seems best, as Miss Vail has suggested, to regard this as a distinct species.

II.—NOTES ON ASCLEPIAS VERTICILLATA AND SOME NEARLY RELATED SPECIES.

In the large amount of material pertaining to *Asclepias verticillata* and its two varieties which has passed through my hands during the past year, several recurring forms have convinced me that there are more than a single species with two forms to be segregated from it. I am not at all prepared to say that I have solved the question, for in the matter of nomenclature as well as in the study of the plants themselves, there is still considerable research to be made, and I offer this only as a preliminary study with a hope that it may bring to me more material for a longer and fuller investigation. The rootstocks, in many cases, have shown interesting features, but as that portion of the plant in *Asclepias* is most difficult to collect, it is only in rare cases that satisfactory specimens have come under my notice, and I have not been able to examine enough of them to determine whether they possess constant characters or not.

The well-known and well-defined *Asclepias Mexicana* of the West Coast is included in this study, as some of its narrow-leaved forms have become confounded with what I take to be *A. galioides* H.B.K.

The following key, perhaps, will be a help in recognizing the species as I now understand them :

Key to the Species.

§ Follicles erect on erect fruiting pedicels.

Flowers greenish and white, or in no. 1 sometimes tinged with purple on the outside.
  Hoods not exceeding the anthers.
    Leaves verticillate in whorls of 2–4's, narrowly linear ; rootstock short, covered with fibrous rootlets. 1. *A. verticillata.*
    Leaves very crowded, whorled or scattered, filiform, 2–3 cm. long ; stems tufted from a woody rootstock. 2. *A. pumila.*
    Leaves approximated in whorls of 3–6's, not crowded, linear, 4–10 cm. long ; stems solitary or tufted from a long horizontal rootstock. 3. *A. galioides.*
    Leaves approximated in whorls of 3–4's, narrowly linear, 4–10 cm. long, close and crowded at the base, elongated and often opposite above. 4. *A. subverticillata.*
    Leaves opposite, linear, 4–8 cm. long ; margins slightly revolute : umbels lateral, small. 5. *A. linearis.*
  Hoods exceeding the anthers ; leaves opposite, linear, 7–14 cm. long ; umbels few, corymbosely terminal. 6. *A. linifolia.*
Flowers ash-colored or the hoods whitish ; leaves lanceolate or linear-lanceolate, spreading or falcate-reflexed, 6–12 cm. long, with ascending veins. 7. *A. Mexicana.*

1. ASCLEPIAS VERTICILLATA L. Sp. Pl. 217. 1753.

This species was based on "*Asclepias foliis verticillatis lineari-setaceis*" Gronovius, Virg. 26. 1739, which in its turn was founded on "*Apocynum Marianum erectum Linariae angustissimus foliis umbellatum—Apocyno recto non ramoso. Rorismarini foliis umbellis florum candidis*" Plunkenet, Mantissa, 17. *pl.* *336.* 1700. The figure is a very good one, and there is no doubt as to what plant was intended. It is the species common on our eastern seaboard and western praires ; but probably not what passes as *Asclepias verticillata* in Mexico nor the forms known as *A. verticillata* var. *subverticillata* in the Southwestern States.*

The species as we know it in the vicinity of New York, as well as from specimens collected all over the country, seem very constant in the following important characters :

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* *Asclepias Simpsoni* Chapm. Fl. ed. 3, 346. 1897, a low pine barren species from South Florida, is nearly related to *A. verticellata*, but I have not seen authentic specimens of it.

Rootstock short, covered with numerous fibrous rootlets, stems angled, glabrate or minutely pubescent in lines, simple or more rarely branched. Leaves opposite or whorled (in depauperate specimens sometimes all of the upper leaves are opposite), all very slender and revolute, though specimens are found which have plane leaves. The umbels are rarely more than 2.5 cm. in diameter, and are situated in alternate axils of the leaves, though occasionally a specimen is seen with opposite umbels and more rarely with two or three umbels together, or in some robust specimens an umbel is seen for each leaf. The corolla-segments are greenish, with sometimes slight traces of purple on the outer surface; hoods white, with a darker keel when dry, truncate at the apex, lobed at the distinctly angled sides, scarcely reaching the summit of the anthers; anther-wings entire or minutely notched. The horns are much exserted and often meet or overlap over the stigma.

It occurs in dry and often sterile soil from Maine to the Northwest Territory, south to Florida, and Texas. It may also possibly be found in Arizona, and I have seen two specimens from New Mexico (Vasey, Herrick), but as yet have not seen any from Mexico which I could refer to *A. verticillata*. The species so-called which does occur there is, I am inclined to think, *Asclepias galioides* H.B.K. and a good species.

In Hemsley, Biol. Centr. Am. **2**: 327, 1881–82, *A. verticillata* is listed as a Mexican species, but the plants enumerated in confirmation of the statement, those of Parry and Hartweg, are what have been known as *A. verticillata* var. *subverticillata*. Hartweg's plant from Leon, Mexico, is so labeled in Herb. Gray, and in every particular answers the description of the plant of H.B.K.

2. ASCLEPIAS PUMILA (A. Gray) Vail; Britt. & Brown, Ill. Fl. **3**: 12. *f. 2921.* 1898. Ined.

Asclepias verticillata var. *pumila* A. Gray, Proc. Am. Acad. **12**: 71. 1876.

This species is characterized by a ligneous base and short woody rootstock apparently without the fascicled fibrous rootlets of *A. verticillata*. The stems are lower with the same narrowly linear or filiform revolute margined leaves, but commonly much more crowded and scattered, and numerous and small umbels of white flowers which are solitary or corymbosely disposed at the summit of the stems. This species occurs on dry plains from South Dakota to Arkansas, Colorado and New Mexico. It may possibly intergrade with *A. verticillata*, but a long series of specimens are constant to the above characters.

3. ASCLEPIAS GALIOIDES H.B.K. Nov. Gen. et Spec. **3**: 188. 1818.

Asclepias verticillata var. *subverticillata* A. Gray, Proc. Am. Acad. **12**: 71. 1876. In part.

Glabrous except for the minutely pubescent stems and pedicels. Stems erect, solitary or fasicled? from a sometimes long horizontal rootstock, 4–10 dm. high or more, glabrous or minutely pubescent in lines above, simple or branched: leaves commonly erect or spreading, in whorls of 3–6; blades narrowly linear, 6–8 or possibly 10 cm. long, 1–2.5 mm. wide, usually coriaceous; margins entire or revolute; midvein conspicuous beneath and the veins obsolete: inflorescence cymosely terminal or often many of the umbels also lateral: peduncles longer than the 1 cm. long pedicels and shorter than the leaves: umbels 2–3 cm. in diameter: corolla-segments greenish white, oblong, obtuse, 4 mm. long: column nearly 1 mm. high, slender: hood nearly reaching the summit of the anthers, erect-spreading, broadly rounded at the apex, the dorsally hastate-sagittate ventral margins slightly involute, entire; horn arising from the base of the hood, flat, long-exserted and somewhat inflexed over the anthers: anther-wings slender, minutely notched at the angled base: follicles 5–7 cm. long, glabrous or minutely puberulent, acute or attenuate above: seeds 5–6 mm. long, thin, glabrous; coma 2.5 cm. long.

Kansas: Popinoe, no. 34, 1875. *Colorado:* Eastwood. *New Mexico:* Lieut. Abert; Wright, low grounds, near San Elizario, 1° to 3° high, June 14th, no. 1685, nos. 1688 and 1689, 1852; Fendler, no. 694; Rothrock, no. 77; Vasey; Dewey; Manson and Hopkins, 1889. *Arizona:* Toumey, no. 248; Lemmon; Knowlton, nos. 219 and 224; M. E. Jones, no. 4063; Rusby, 1883; Palmer; MacDougal, no. 386; Mexican Boundary Survey, no. 1078. *Mexico:* Hartweg, no. 216; Schaffner, no. 59; Sonora Valley, Schott; Parry and Palmer, no. 584; Palmer, no. 809; Parras, Gregg; Edwards.

Some of these specimens (Popinoe, Rothrock, Gregg, etc.) are very close to some narrower leaved forms of *Asclepias Mexicana.* A specimen of Dr. Rusby's collection of 1880 from the neighborhood of Santa Fe, N. Mex., in Herb. U. S. Nat. Mus., is considerably lower than any of the specimens mentioned above, is less than 2 dm. high and more bushy than any of the plants enumerated here.

The *A. verticillata*, no. 1078 of the Mex. Bound. collection, is undoubtedly the same as Hartweg's plant, and I believe is also the plant described as *A. galioides H.B.K.* and neither are connected with *A. verticillata* except as to their verticillate leaves and small white flowers. A close study of the flowers of *A. verticillata* will reveal characters which do not belong to those of *A. galioides.*

The hoods in *A. verticillata* are nearly as truncate at the base as at the summit, and have a very noticeable involute angle or lobe on the ventral margins. On the contrary, Hartweg's specimen and with it all the so called *A. verticillata* var. *subverticillata* from the Southwest have hoods which are rounded at the summit, with infolded ventral margins and a gradually decurrent base which is but slightly truncate.

In E. Fournier's study of some Mexican Asclepiads (Ann. Sci. Nat. VI. **14**: 373. 1882) two forms are given of the species as occurring in Mexico, preceded by a general description after the habit of many foreign botanists. Under "Foliis angustioribus," var. *α galioides* Kunth is included all the North American material, apparently based on the plate in Hooker, Fl. Bor. Am. **2**: 54. *pl. 144.* 1834, which is undoubtedly the true *A. verticillata* (though the enlargement of the hood is a very bad one) and is the only reference to the North American forms, for the other specimens given are Lindheimer, Fasc. III, no. 456* and Fasc. IV., no. 657; Fendler, no. 694; Parry and Palmer, no. 584 from San Luis Potosi; Hartweg, no. 216; Bonpland, no. 4304 from Lake Cuses, Mexico; most of which are forms of *A. galioides* H.B.K.

Under "Foliis latioribus" var. *β. Mexicana* Cav. is all the material which we know as *Asclepias Mexicana*, a species which occurs from Idaho to Mexico and of which a very good plate is given in Cavanilles, Icones, **1**: 42. *pl. 58.* 1791.

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*For this number see *Asclepias subverticillata.*

4. ASCLEPIAS SUBVERTICILLATA (A. Gray).

Asclepias verticillata, var. *galioides* Torr. Mex. Bound. Surv. 164. 1859. In part.

Asclepias verticillata, var. *subverticillata* A. Gray, Proc. Am. Acad. **12**: 71. 1876. In part.

Glabrous except the minutely pubescent stems and pedicels. Stems slender, erect, 2–3 dm. high, from a slender vertical rootstock, simple or branched; internodes at the base of the stems 5–10 cm. long; leaf-scars remaining conspicuous: leaves crowded, opposite above, otherwise verticillate in threes or fours; blades narrowly linear, 4–10 cm. long, 1–2 mm. wide, acute at each end, coriaceous, with a whitish midvein: umbels 4–8, lateral and terminal, 2–2.5 cm. in diameter, corymbosely disposed at or near the summit of the stem, commonly many-flowered: peduncles longer than the minutely pubescent pedicels and considerably shorter than the upper often elongated leaves: corolla-segments greenish-white, 4–5 mm. long, obtuse or acutish: column nearly 1 mm. high: hoods erect-spreading, nearly as high as the anthers, dorsally hastate-sagittate at the base, broadly rounded at the summit, the ventral margins rounded, not angled at the slightly involute middle: anther-wings narrow, very slender, prominently sagittate at the minutely notched base: follicles 8 cm. long, slender, long-acuminate, minutely puberulous: seeds about 4 mm. long; coma 2 cm. long. Mature fruit not seen.

New Mexico: Wright, no. 1686, 1851–52, in Herb. Columbia University. *Western Texas:* Wright, "mountain valley beyond the Limpia, Aug. 26th," no. 550, and "valley, 20 miles beyond the Pecos, Aug. 17," no. 551, 1849 in Herb. Gray. *Arizona:* Fort Verde, E. A. Mearns, no. 235, in Herb. Columbia University.

Asclepias verticillata, var. *subverticillata* was established by Dr. Gray, based "chiefly" on *Asclepias verticillata*, var. *galioides* Torrey (Mex. Bound. Surv. 164. 1859). In that publication Dr. Torrey bases his variety on a specimen of Parry's from Sonora and New Mexico, and on three numbers of Charles Wright's collection of 1851–52, nos. 1685, 1686 and 1689, adding that "our plant seems to be the same as Hartweg's no. 216." Specimens of these last-mentioned numbers are preserved in the Herbaria of Columbia University, Harvard University, and the U. S. Nat. Museum. I am not sure that I have seen Parry's specimen, which, according to the copy of the Report of the Mexican Boundary Survey annotated by Dr. Torrey, should be numbered 1078a. A specimen from this collection in the Herbarium of the U. S. Nat. Museum answers the description very well, but lacks any kind of a number so I do not like to refer to it with certainty. The first number of Wright's (1685), is undoubtedly the same as Hartweg's plant and is *A. galioides*, H.B.K.; but the no. 1686 seems to show a marked variation which is rather striking. The same plant occurs is Wright's Western Texas collection and more recently has been found at Fort Verde, Arizona.

A low (2–3 dm. high), slender plant, with remarkably crowded, long, narrowly linear leaves which are verticillate in fours or the uppermost in twos or threes. The internodes at the base of the stem are only from 6–10 mm. long and the leaf-scars are conspicuous, a character which I have not noticed on any other forms. I have little doubt but that this is a good species and give it the name of *Asclepias subverticillata* as it is included in Dr. Gray's variety.

5. ASCLEPIAS LINEARIS Scheele, Linnaea, **21**: 758. 1848.

Glabrous except the minutely pubescent stems and pedicels. Stems terete, angulate above, 2–5 dm. high, from a rather slender, short rootstock, covered with few ligneous? rootlets, simple or branched near the base, minutely pubescent, commonly in lines above: leaves narrowly linear, 4–8 or 10 cm. long, 1–3 mm. wide, elongated, acute, glabrous or with few scattered hairs, 1-nerved, the veins obsolete, coriaceous, margins revolute: peduncles longer than the 1 cm. long, filiform, minutely puberulous pedicels, but much shorter than the leaves: umbels 3–8, all lateral, 1.5–2.5 cm. in diameter, few to several-flowered; column slender, conspicuous: corolla-segments greenish white, about 4 mm. long, elliptical-oblong, acutish: hoods erect-spreading, broadly truncate at the summit, truncate at the hastate-sagittate obscurely clawed base; ventral margins with rounded angles or lobes at the middle, somewhat involute: horn flat, arising from the keel of the hood near its base, arcuate, horizontally long-exserted over the anthers, often dorsally angled at about the middle: anther-wings very slender, minutely notched at the angled base. Follicles not seen.

Southwestern Texas: Lindheimer, nos. 348 and 631 in Herb. Gray, no. 456 in Herb. U. S. Nat. Mus.; Guadalupe, 105 miles southwest of San Antonio, Edward Palmer, no. 810 in Herb. Gray and Herb. Canby; San Diego, Miss Mary B. Croft, no. 209 in Herb. Columbia University.

The specimen on which *Asclepias linearis* Scheele was based is said to grow "gesellshaftlich auf schwarzem Thonboden und feuchter Prairie bei Neubraunfels: Lindheimer, Aug." A specimen from that region growing in "hard, clayey soil, N. Br." collected by Lindheimer and labelled *Asclepias linifolia*, no. 631, June 1851, is preserved in Herb. Gray. It is annotated by Dr. Gray as *Asclepias verticillata* var. *subverticillata*. It is undoubtedly the plant described by Scheele, and is more nearly related to *Asclepias verticillata* than the other plants which have passed as so-called varieties. An *Asclepias verticillata*, var. *linearis* has recently been established by C. L. Pollard (Bull. Tor. Bot. Club, **24**: 156. 1856), but the specimens so labeled which have come to us are only depauperate specimens of the true *Asclepias verticellata* and not the plants described by Scheele.

In Roemer and Schultes, Syst. **6**: 70. 1820 under *Asclepias angustifolia* there is a reference to an "*Ascl. linearis*." I have not been able to trace this species and retain the name for the Texan plant until I can determine to what species the earlier publication of it applies.

6. ASCLEPIAS LINIFOLIA H.B.K. Nov. Gen. et Sp. **3**: 190. 1818.

Asclepias salicifolia Lodd. Bot. Cab. *pl. 272*. 1823.

Asclepias Arizonica Greene. Name only in Herb. Gray.

A low shrub, glabrous except for a minute pubescence on stems and pedicels. Stems erect, 4–6 dm. or 1 m. high, solitary or several together or 1–2 or more at intervals from a stout rootstock, commonly branched, minutely pubescent, mostly in lines above: leaves opposite, tapering to a slender petiole; blades narrowly linear, 7–14 cm. long, 2–3 or 4 cm. wide, acute at each end, glabrous; margins often revolute; midvein whitish, the widest leaves with obscure but ascending veins: umbels lateral, several, on peduncles longer than the 1 cm. long pedicels, several to many-flowered: corolla-segments greenish-white, 3.5–4.5 mm. long, acutish: hoods erect, white, one-third higher than the anthers, rounded at the summit, dorsally hastate-sagittate at the base; ventral margins slightly involute, entire; horn flat, falcate, adnate to the keel of the hood from the base up to about the middle, long-exserted over the anthers: anther-wings slender, angled and salient at the base, apparently entire: follicles very slender, 4–4.5 cm. long, glabrous, tapering at each end: seeds 4 mm. long, very thin: coma 1.5 cm. long.

A species easy to distinguish from its allies by the hoods, which exceed the anthers, a character which never occurs in any of the species enumerated above as being related to *A. verticillata*.

Arizona: Santa Catalina Mts., Lemmon, 1881, and "by streams of Santa Catalina Mts.," Pringle, 1881; Huachuca Mts., Lemmon, 1882; Fort Huachuca, T. E. Wilcox, 1892. *Mexico:* San Luis Potosi, Schaffner, no. 58, in Herb. Canby; State of Nuevo Leon, Pringle, no. 1895 in Herb. Columbia University.

A small specimen said to have grown "in Mr. Hogg's garden 1825, raised from seeds collected by Dr. James in Long's Expedition to the Rocky Mountains" is preserved in Herb. Torrey. It appears to belong here, but the flowers are in too poor a condition to make it certain. The sheet on which it is pasted bears a note by Dr. Gray to the effect that "it most likely equals *A. virgata* Lagasca, but has the horn too long."

A specimen from San Luis Potosi, collected by Parry and Palmer, no. 581, might also be referred to this species and in fact it is partly so labelled, but it is much more branching in habit and has somewhat shorter leaves.

Asclepias linifolia is referred to *Asclepias angustifolia* Schweiger, Enum. Hort. Bot. Regiomont, 13. 1812 by Hemsley, but Fournier (Ann. Sci. Nat. VI. **14**: 376. 1882) notes that it would be difficult to determine whether it belongs to *A. linifolia* or to *A. virgata* Lag. (1804). I have seen no authentic specimens of the latter species. It is said to have "Corollae albae, colore roseolivido suffusae."

The plant in Loddiges' Catalogue was made from a specimen raised from seed, habitat unknown, but it seems to be our plant except for the somewhat broader leaves, and is the same as and probably the origin of many garden specimens.

Should all of these names fail to belong here I have added to them the name which appears on a plant collected by Lemmon in Herb. Gray, Prof. Greene having long ago recognized it as a good species.

7. ASCLEPIAS MEXICANA Cav. Ic. **1**: 42. *pl. 58.* 1791.

This species is a tall, stout, branched plant, woody at the base, from a short rootstock, with linear-lanceolate, spreading leaves, which are whorled in 3–6's, acute at each end, with ascending veins. In some specimens the upper leaves are plicate and falcately drooping. Inflorescence cymosely terminal and often numerous umbels in two or three of the lower axils. The umbels are about twice or more larger than those of *A. verticillata* and in some cases a little smaller than those of *A. galioides*. The flowers are also commonly more numerous than in either of the foregoing species, the corolla-segments are ash-colored and the hoods white; the ventral margins of the latter are rounded and without the distinct angle or lobe of *A. verticillata* and with a somewhat shorter horn. The follicles are slightly larger and less slender and the plant usually fruits more abundantly than those of *A. verticillata.*

A species common in the Western States and which varies greatly in the size of the leaves and the color of the flowers. Smaller, more slender forms have been collected in eastern Oregon by F. E. Lloyd; in Lake County, California, by Mrs. O'Neil, apparently growing with the type; they are probably only young plants. Another quite remarkable form, with uniformly shorter, very coriaceous leaves, comes from Mexico, where it has been collected by Pringle, no 2574, as to specimen in Herb. Columbia University.

New American Hepaticae.

By Marshall A. Howe.

(Plates 336, 337.)

Scapania (?) heterophylla.

Plants obscurely complanate, dark green, often bleaching at apices on drying, erect or ascending, forming compact cushions: stems 4–6 cm. high from a rhizomatous base, rigid, fastigiately and subdichotomously branched, brown, becoming almost black, nearly or wholly destitute of root-hairs, denudate below, 20–30 cells in thickness: leaves scarcely increasing in size upward, sometimes smaller at the stem-apex, the upper erecto-patent, subimbricate, the lower approximate, more spreading, often with squarrose tips, all strongly undulate-crisped both when moist and when dry, bilobed to the middle or bipartite, complicate, the carina acute or somewhat rounded, but never winged, the lobes sometimes almost disunited; now and then with an unlobed leaf irregularly interpolated, most frequently in the position of an underleaf; margins of the lower leaves commonly erose, of the upper entire or sparingly denticulate; ventral lobes twice as large as the dorsal or subequal, 1.7–2.5 mm. in length, .85–1.6 mm. in maximum width, broadly obovate, elliptical, or obovate-oblong, usually decurrent, mostly rounded-obtuse at apex; dorsal lobes obtuse, obliquely and broadly ovate or elliptical, not decurrent, sometimes appressed at stem-apex, especially on the younger shoots, but mostly ascending or slightly squarrose-reflexed: leaf-cells generally opaque, with smooth or slightly roughened cuticle, near the margin subquadrate or roundish-hexagonal, 16–28 μ, near the base oblong, 60–90 $\mu \times$ 25–30 μ; trigones indistinct or wanting: remaining parts unknown. (Plate 336.)

On submerged stones in a cold mountain stream (alt. 3500 ft.) in company with *Chiloscyphus polyanthos rivularis* and *Porella rivularis*, Sisson, Siskiyou Co., California, July, 1894 (Howe, no. 34).

The stream, which is formed by a great spring beside the railway track about three-fourths of a mile north of the village of Sisson, is said to maintain nearly a uniform volume throughout the year, and as the plants were found wholly under water in the last of July and the first of August, it is probable that their submersion is permanent.

The plant described above was referred at first, uncritically, to *Scapania undulata* and listed under that name in Erythea (**4**: 49. 1896). From *S. undulata*, however, it is certainly very distinct in the obscurely complanate branches, in the sometimes 3-ranked, often more deeply lobed, erecto-patent, never alate-carinate, leaves, with more or less squarrose tips, and in the obovate rather than round-trapezoidal ventral lobes. The interpolated unlobed leaves stand sometimes in about the general position of dorsal or ventral lobes, but more often squarely subtend the ventral surface of the stem. They can doubtless be explained in some cases, from the point of view of ontogeny, by the separation of the normally united lobes, but in other cases this hypothesis seems to find little justification. We have noticed one or two *three*-lobed leaves out of hundreds examined and in such the complete disjunction of the most ventral lobe would have thrown it nearly into the place of an underleaf. When the leaf-lobes are subequal it is often difficult to distinguish between the dorsal and ventral aspects of the stem, especially if further confused by the presence of the supernumerary entire leaves. From stems of such a character as this, however, may spring young shoots in which the leaves are regularly distichous and acutely complicate, in the ordinary *Scapania* fashion, with the ventral lobes twice the size of the dorsal. In the axils of the upper leaves are sometimes to be found numerous short clavate paraphyses, unicellular or of two or three oblong cells in a lineal series.

It is possible that the species deserves to be separated generically from *Scapania*, but in absence of perianth and sporogonium, we can do no better than refer it to a genus with which it surely has very much in common. Our material is sufficiently ample to allow its distribution at an early date in Underwood and Cook's *Hepaticae Americanae*.

RICCIA TRICHOCARPA.

Thallus in rosettes about 2 cm. in diameter or forming somewhat irregularly radiating masses; the principal divisions linear, 2–6 times dichotomous, .75–1.5 (mostly 1) mm. in width, often black below and at margins, densely clothed at the sides with white or tawny setæ .3–.65 mm. long, those toward the apices often in as many as 8–12 irregular series, mostly distinct at insertion, with sharp, rigid, rarely slightly uncinate points, the terminal thallus-lobes obcuneate or oblong-elliptical, obtuse or subacute, narrowly and rather deeply unicanaliculate toward the apices or subbicanaliculate, the furrow at the extremities commonly concealed by the trichomes, the median sulcus sometimes nearly vanishing toward the base, margins obtusely rounded, tumid, often connivent on drying, the furrow then thatched by the somewhat forwardly directed setæ; dorsal surface light green, minutely and regularly reticulate; ventral surface nearly plane and flat, with a few very inconspicuous scales on either side of the median line at the apices, falsely squamose in the basal parts through delamination due to marcescence; width of transverse sections 1.6–3 times their height, the posterior subquadrangular with a light median sulcus, the margins becoming more tumid and rounded in proceeding toward the apex and the sulcus now and then double, the sections convex ventrally only in the extreme apical region; 20–28 cells in thickness, texture nearly solid, the air-chambers narrow and vertical; epidermis primarily bistratose, the superficial layer at first papillate, afterwards collapsed, and in the older parts reduced to a flattened cellulose membrane incumbent on the lower layer: monoicous: antheridia scattered, the ostioles elevated about .1 mm.: sporogonia numerous, in a single or double series, immersed, finally—especially when dry—hemispherical-protuberant above, together with the long-unruptured covering, or subconical, the covering marked with a dark-purple spot and bearing with rare exceptions 1–12 setae; spores soon black and very opaque, narrowly or not at all margined, 90–120 μ in maximum diameter, minutely granulose-papillate, with 9–12 areolae (visible only in the younger spores) across the convex face, the walls of these with irregularly thickened and salient angles, thus often giving this face in profile the appearance of bearing columnar or wart-like elevations, areolae across one of the plane faces 5–7 in number, scarcely elevated at the angles. (Plate 337.)

On rather dry and rocky soil. *California:* about San Francisco, "Mission Dolores," "Turk St.," "near Ocean House" (Dr. Bolander), Mission Dolores (Howe); Berkeley (Howe); Ukiah (Howe); San Mateo Co. (Prof. D. H. Campbell); Palo Alto (S. E. Brown); Santa Ana Hills (Parish); Pasadena (McClatchie).

Exsicc. Hep. Bor.-Am. 143^{b} (as *R. tumida* Lindenb.).

Hep. Am. 138 (as *R. arvensis* Aust., var. *hirta* Aust.).

The above is the Californian *Riccia* that has been referred variously by American authors to *Riccia ciliata* Hoffm., *R. tumida* Lindenb., *R. intumescens* Aust. MS., Underw. (*R. ciliata* Hoffm., var. *intumescens* Bisch.) and more recently to *Riccia hirta* Aust. (*R. arvensis* Aust., var. *hirta* Aust.). But *Riccia arvensis hirta* * known only from Mr. Austin's specimens from the neighborhood of Closter, New Jersey, bears comparatively few, short, usually blunt-pointed and incurved papilla-like cilia .1–.3 mm. long (not *setae*), the thallus is strongly incrassate-carinate ventrally, the margins are acute, the epidermis is very thick, of 2 or 3 layers of

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* The relationship of Mr. Austin's var. *hirta* of his *Riccia arvensis* to his *Riccia Lescuriana* is still obscure to us. A study of Hep. Bor.-Am. 141 (*R. arvensis*) and Hep. Bor.-Am. 143 (*R. Lescuriana*), which may fairly be considered the types of these species inasmuch as they were cited after the original diagnoses (Proc. Acad. Nat. Sci. Philad. **1869**: 232. 1869), though not distributed until four years later, shows important differences between the two. *R. Lescuriana* is a larger plant, with longer and broader segments, and its spores are 75–100 μ in maximum diameter, with thick-walled, strongly defined areolae on the outer face, 7 or 8 measuring its width, the inner faces nearly smooth, minutely granulate-papillate, or very faintly and irregularly reticulate, while *Riccia arvensis* has somewhat smaller spores (70–90 μ) with all the faces distinctly and almost equally areolate. But Hep. Bor.-Am. 142, issued as *R. arvensis* Aust. var. *hirta* and cited by Mr. Austin after his original description of this variety, in Professor Underwood's set agrees with *R. Lescuriana* in every detail of importance; in the copy in the possession of Columbia University, however, we find a plant intermediate between the typical *R. arvensis* and *R. Lescuriana* both as to thallus- and spore-characters, mixed with *R. sorocarpa* Bisch. In all the specimens alluded to, the cilia when present are confined to the margin, though in the original description of the var. *hirta* (*l. c.*) we read, "*supra omnino hirta*," which, however, in the Hep. Bor.-Am. was changed to "*supra usitate hirta*." But there is, in the possession of Professor Underwood, a specimen labeled in Mr. Austin's handwriting simply, "Rocks, Palisades, N. J., C. F. A., Sept. 1863," in which the short cilia are not confined to the margin but are scattered over the dorsal surface. The spores in the latter are nearly like those of the typical *Riccia arvensis*, but there are differences in general habit, in the form of the lobes, and in the character of the median sulcus which make its reference to the same species doubtful. But whatever the relation of *R. arvensis hirta* to *R. Lescuriana*, none of the New Jersey specimens have anything to do specifically with the Californian plant described above.

It may be remarked that *R. Lescuriana* was considered by Lindberg (Musc. Scand. 2, 1879) a synonym of *R. Michelii* Raddi; but *R. Michelii* ("*typica* * * * *e loco classico*") according to a specimen which we owe to the kindness of Dr. Levier of Florence, has spores that are distinctly reticulate on the inner faces, while those of *R. Lescuriana* are typically quite otherwise as already indicated; moreover, *R. Michelii*, together with its varieties, is said by Dr. Levier to be always dioicous, while the American plant appears to be always clearly monoicous. The antheridial ostioles are equally prominent in both.

decolorate or purple-tinged cells, the somewhat smaller, more distinctly margined spores are fuscous-brown at maturity and always show their areolae quite clearly in glycerine instead of being densely black and opaque as in *R. trichocarpa* under the same treatment, the plants are mainly smaller and less frequently dichotomous, the thallus-segments are usually comparatively broader, reddish-purple below and more evidently squamigerous.

A much nearer ally of *Riccia trichocarpa* is doubtless *R. ciliata* Hoffm. of Europe. From the typical form of this, however, the Californian plant is clearly distinct in the shorter and much more abundant setae (these often reach 1 mm. in length in *R. ciliata*), in the presence of trichomes over the sporogonia, in the rather larger size of the thallus, more acute-angled dichotomy, and in the commonly black margins and sides. From *R. ciliata* var. *intumescens* Bisch., known to us only from the excellent figures and description of its author, our specimens evidently differ in the longer, narrower segments, in the even more crowded lateral setae, those toward the apex often in as many as 8–12 irregular series, and in the normal presence of 1–12 long trichomes above each sporogonium, while in regard to the "cilia" of *R. ciliata intumescens* Bischoff* says, "*rarius quoque in superficie frondis dispersa.*" In *R. ciliata*, the tissues covering the mature sporogonium soon become thin, scarious, and shining, and finally break away in fragments, exposing the capsule and the spores, and Bischoff remarks of the capsules of the var. *intumescens*: "*post maturitatem rupti, foveolas sporis repletas in frondis pagina superiore relinquentes*"; while in *R. trichocarpa* the covering of the capsules remains very long intact—indeed, in only one case out of several specimens with spores evidently much past maturity, have we seen the contents of a capsule exposed by natural agencies.

Riccia crinita Tayl. from Swan River, Australia (Drummond, no. 42), the original of which we have seen through the kindness of Dr. B. L. Robinson, is close to *R. trichocarpa* in character and number of setae, which also sometimes occur over the sporogonia. But *R. crinita* is a smaller plant, only 2 or 3 times dichotomous, with shorter, oblong rather than linear segments, the thallus is

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* Acta. Acad. Caes. Leop. Carol. Nat. Cur. **17**: 1063. 1835.

comparatively much thinner, the vertical sections of its segments being 3–7 times as wide as high, the margins are acute and commonly incurved; the spores (possibly not arrived at full depth of color) are light-brown, 75–90 μ in maximum diameter, with 11–14 smaller areolae across the convex face, this scarcely papillate in profile, the plane faces similarly areolate, the mesh-forming ridges throughout and the narrow margin nearly smooth.

Riccia Michelii Raddi, var. *ciliaris* Levier (= *R. tumida* Lindenb. and *R. palmata* Lindenb. *fide* Levier) differs so widely from our species that a detailed comparison is unnecessary.

R. trichocarpa may be found with archegonia and antheridia in January and early February, ripening its capsules in April and May. Like all the Californian *Ricciae*, it is practically invisible during the summer months.

It was our first thought to take up for this species the name *Riccia Bolanderi* Aust., which a fragment (presumably from the Herbarium of the California Academy of Sciences) now in the Underwood Herbarium is said originally to have borne, and we have already sent one specimen to Europe under this name. But, in one of the very last of the acute Mr. Austin's works—his descriptive treatment of the Hepaticae of California, prepared for the "Botany of California,"* but never published—he refers this plant, which he had previously distributed as *R. tumida* Lindenb. (Hep. Bor-Am. no. 143^b) to *R. intumescens*, raising Bischoff's variety of *R. ciliata* to specific rank, and without making any allusion to having at some time made use of an unpublished name, *R. Bolanderi*, for the same thing. This reference to *R. intumescens* would appear to have been Mr. Austin's final opinion in the matter, and under the circumstances it seems to us to be fairer to assume the responsibility of the attempt at disentangling this Californian *Riccia* from its various allies and to give it a name of our own choosing.

Hep. Am. 138, collected in San Mateo Co. by Prof. D. H. Campbell, we consider the type of the species.

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* Brewer, Watson, and Gray, Botany of California (Geological Survey of California), 2 vols. 1880.

RICCIA LAMELLOSA Raddi, Opusc. scient. di Bol. **2**: 351. *pl. 15. f. 2.* 1818.

Var. AMERICANA. Spores brown, 75–126 μ in maximum diameter, obscurely angular, wholly destitute of a wing-margin, with 8–12 clearly defined areolae, each about 15 μ in width, across the outer face, the inner faces marked with much smaller and less distinct areolae or simply with irregular vermicular lines.

California: San Francisco (Bolander, Howe); Fruit Vale, Alameda Co. (Miss Edith S. Byxbee). *New Jersey:* Closter (Austin). *Alabama:* Mobile (Mohr).

The principal peculiarity of the spore of the American *R. lamellosa* was first remarked upon by Professor Underwood (Bot. Gaz. **19**: 274. 1894). The European plant has distinctly wing-margined and plainly angular spores, and the markings of the inner and outer faces are nearly uniform; the ridges of the outer face are more vermicular than in the var. *Americana* and less often form perfect areolae, and when the areolae are well defined, they are smaller and more numerous, 14 or 15 measuring the diameter of the outer face. For comparison we have made use of a specimen from Florence, Italy (the type locality), and one from Sicily, both kindly communicated by Dr. E. Levier.

The Alabama and New Jersey specimens show practically the same characters as the Californian with the exception that the spores of the latter are larger, ranging from 90–126 μ in greatest diameter, while in the eastern and southern plants they measure but 75–100 μ. The Californian plant appears to produce capsules rather sparingly.

ASTERELLA LATERALIS.*

Thallus simple, or innovating latero-ventrally or in front, mostly oblong to linear, 7–25 mm. × 1.5–4 mm., rather effusely costate-carinate, about 25 cells thick in the middle, becoming very thin at the broad, brownish or decolorate and subpellucid, lightly undulate-crenulate margins, somewhat flatly and narrowly

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* In accordance with the later practice of Lindberg and others, we use *Asterella* (Pal. de Beauv., 1810) for the genus to which Nees in 1820 gave the name *Fimbriaria*. *Asterella*, as has been recently pointed out by Professor Underwood (Bot. Gaz. **20**: 59. 1895), is the name of this group, whether by the "method of residues" or by application to the first species cited under it by its author.

crescentic in cross-section when moist, rigid and canaliculate or subconvolute on drying, dark-purple beneath, very obscurely areolate and porose above, solid in texture, the air-chambers almost wholly filled by secondary walls; scales small, purple, in a single series on either side of the costa, reniform or ovate, the anterior abruptly narrowed to a lanceolate or filiform reddish-purple point, which very rarely exceeds the apical margin: monoicous: androecia and ♀ branches on small latero-ventral innovations, those bearing a ♀ branch expanded, emarginate, bilobed or somewhat obcordate, 2–3 mm. long, 1–2.5 mm. in maximum width, with filiform-pointed inflexed scales at apex, androecium-bearing innovations smaller, scarcely expanded distally: ♀ receptacle subhemispherical, lightly papulose, becoming nearly smooth, 2–2.5 mm. in maximum width, with distinct and finally divergent lobes, maturing 1–4 (commonly 2 or 3) sporogonia, pilose-barbate beneath; pseudoperianth white, the exserted portion conical or conical-oblong, about 8-cleft, the segments often free with age; peduncle pale straw-colored, 1–1.5 cm. high, pilose at first, becoming naked: capsule circumscissile near the middle; spores brown, opaque, 75–90 μ, very minutely granulose papillate, the angles with a narrow concolorous margin, the faces exhibiting a few low ridges, these often uniting to form 2–4 shallow rather irregular areolae across each face, the more mature and opaque spores appearing simply warty-rugose in outline or subentire; elaters brown, 140–220 μ long, 15–21 μ in greatest width, bispiral, obtuse, occasionally branched.

Colomas, State of Sinaloa, Mexico (alt. 3000 ft.), (Dr. J. N. Rose, July 18, 1897); also, plants with quite immature sporogonia, by the same collector, in the Sierra Madre at Tepic, Mexico, Aug. 1897.

Asterella lateralis is an ally of *A. Bolanderi* (Aust.) Underw., but differs in the somewhat smaller ♀ receptacle, in the usually 8-cleft instead of 10–12-cleft pseudoperianth, and very markedly in the character of the spores and elaters—the spores of *A. Bolanderi* being deeply alveolate-areolate (4–6 meshes across each face) with a conspicuous pellucid margin, the elaters being 200–250 μ long and only 8–10 μ in width. As in *A. Bolanderi*, a tendency to dioicism is observed.

The only other species of *Asterella* with androecia and ♀ branches on small postical innovations known to us, outside of the American *A. Bolanderi* and *A. violacea*, are two species from

Africa, *Asterella linearis* (Steph.)* and *Asterella Preussii* (Schiffn.)† and one from Persia, *Asterella Persica* (Steph.),‡ which all differ (judging from descriptions alone) in being dioicous, while *A. Persica* evidently has a thicker thallus, being described as subsemicircular in transverse section, its scales are more prominent, the carpocephalum is 5–6-locular, etc.; *A. linearis* has geminately appendiculate scales, a highly papulose capitulum, and an almost fusiform pseudoperianth; and *A. Preussii* has scales attenuate at the apex into a very long hyaline seta, thicker thallus margins, a purple peduncle 25–30 mm. long, etc. The spores and elaters of these three exotic species are undescribed. The color and markings of the spores in this genus afford valuable characters, in the American forms, at least, for distinguishing species and these particulars have commonly failed to receive the attention that they deserve at the hands of authors. Spores that are nearly opaque in water often show the surface-sculpturing very clearly on examination in glycerine.

Explanation of Plates.

PLATE 336. *Scapania* (?) *heterophylla*. M. A. Howe.

1. An entire plant, $\frac{4}{5}$ the natural size.

2 and 3. Opposite views of a portion of the stem, showing the often three-ranked leaves, × 15.

4. Dorsal view of stem and leaves, × 15.

5. Ventral view of the same object, showing an unlobed underleaf, × 15.

6. The leaf with lobes "a" and "a^1" already shown in figures 4 and 5.

7. A typical underleaf, × 15.

8. Outline of a deeply lobed leaf, × 15.

9. Apex of a branch of the same plant from which figures 4 and 5 were drawn; leaves here distichous, × 15.

10. The leaf "d" from the foregoing, × 15.

11. Ventral view of a leaf, × 15.

12. Cells from near base of leaf, × 244.

13. Cells from the apical margin of one of the upper leaves, × 244.

14. Paraphyses from axils of leaves, × 244.

15. Cross section of the stem, × 32.

PLATE 337. *Riccia trichocarpa*. M. A. Howe.

1 and 2. Portions of the plant, natural size.

3. Terminal segments of a young thallus, dorsal view, × 5.

4. End of a thallus lobe from fig. 1, with ostioles and a sporogonium, × 10.

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* *Fimbriaria linearis* Steph. Engler's Bot. Jahrb. **20**: 302. 1895.

† *Fimbriaria Preussii* Schiffn. Steph. *l. c.* 303.

‡ *Fimbriaria Persica* Steph. Hedwigia, **33**: 7. 1894.

5. Lateral view toward apex of a thallus-segment, showing the numerous trichomes, × 20.

6. Marginal trichomes, × 53.

7. Portions of thallus exhibiting the trichome-bearing elevations above the capsules, × 20.

8–13. Outlines of transverse sections about 10 μ in thickness at selected points from near the apex to the old and shriveled base, × 23. The trichomes do not appear so abundant as might be expected from the material used for microtome sectioning, which may be explained by the thinness of the sections and by the fact that the detached sections and fragments of the trichomes have not always adhered to the glass slides. Fig. 8 shows small median scales.

14. Epidermis and subjacent cells from a younger portion of the thallus, × 225. The superficial layer is here represented as composed of collapsed cells. In the extreme apical region only they are papilliform.

15. Epidermis in older parts of the thallus, × 225. The collapse and disintegration of the cells of the outer layer is so complete that only a structureless cellulose film remains.

16. Cross-section of thallus showing the cell structure and a young sporogonium, × 53.

17. Spores, × 305.

Figs. 1, 2, 4–7 and 17 from Hep. Am. no. 138 collected in San Mateo County, California, April, 1892, by Prof. D. H. Campbell; figs. 3 and 8–16 from material fixed with 1 per cent. chromic acid and preserved in alcohol, collected by the author near Berkeley, California, February 8, 1896.

New Plants from Western North America.—I.

By A. A. Heller.

(Plates 338–340.)

The following species, with one exception, were collected by Mrs. Heller and myself, either in Nez Perces county, Idaho, during the season of 1896, or in New Mexico, in the vicinity of Santa Fé, in 1897. Besides these, a number of others, still undescribed, have been distributed, and it is now the intention to publish them as speedily as possible. The type specimens of all new species described in these papers, are deposited in the herbarium of the University of Minnesota. The drawings for the illustrations were made by Mrs. Heller.

CALYPSO OCCIDENTALIS (Holzinger)

Calypso bulbosa forma *occidentalis* Holzinger, Cont. U. S. Nat. Herb. **3**: 251. 1895.

This western plant is very similar to the eastern *C. bulbosa*, but differs in several points which seem to be constant. The color of the bunch of hairs on the lip is white, instead of yellow. These hairs also appear to be less numerous, straighter, and more slender. The lip also is usually longer, and more slender in proportion. So far as I have been able to ascertain, there is no record of specimens with yellow hairs from any point west of the Rocky mountains. The fact that these hairs are longer and fewer, is also noted in an account of certain Californian plants.* The plant is certainly as worthy of specific rank as many species now recognized by all, and is distinct geographically.

Collected in deep, damp woods, along the Sweetwater, and on the Craig mountain plateau, Nez Perces county, Idaho, June to July, 1896, no. 3185. It is the same as no. 211 of Sandberg, MacDougal and Heller, collected at the same place on the Sweetwater, in 1892, which is the type locality. It has been collected at different places in Idaho, Oregon, Washington and California.

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* Erythea, **4**: 104. 1896.

FRAGARIA BRACTEATA.

Plant spreading, moderately stout, pubescent; rootstalk stout, basal bracts broadly lanceolate, acuminate, tinged with red; mature plant about 15 cm. tall, the flower stalks one-third longer than the leaves; pubescence of flower stalks and petioles floccose, spreading: leaflets obtuse, strongly serrate, the serratures gland tipped; lateral leaflets ovate, oblique on the inside, shorter than the terminal one; terminal leaflets broadly ovate, with cuneate base, 3.5 cm. long: pedicels about 3 cm. long, usually recurved, the lower and sometimes the next succeeding one subtended by a reduced leaf, the others by a simple bract; calyx-lobes nearly 1 cm. long, ovate-lanceolate, long acuminate; calcyine bracts lanceolate, half the length of the calyx; petals white, slightly longer than the calyx, broadly obovate: fruit ovoid, rather small, the seeds superficial. (Pl. 339.)

The type is no. 3615, collected in a meadow along Santa Fe creek, nine miles east of Santa Fe, May 29, 1897, altitude 8000 feet. Starved forms were also collected in damp places on the ridges near Santa Fé. It is probably the same as Fendler's 207, called *Fragaria vesca* by Gray. The pubescence on the leaflets and calyx-lobes is not so plentiful as it is on the stems, and is appressed.

To this well-marked species is referred no. 3279, collected by Mrs. Heller and myself in the vicinity of Lake Waha, Idaho, June 20, 1896, distributed as *F. Americana*, which species it does not very much resemble.

The figure represents a plant three-fourths natural size, and a seed magnified eight times.

HOLODISCUS AUSTRALIS.

A bush 2–3 meters high, growing in clumps; bark covered with gray scales; branches ascending, spreading above, the growing parts reddish, pubescent: mature leaves pale green, about 3 cm. long, 1–1.5 cm. wide, elliptical or elliptical-obovate, with cuneate base, which is prolonged into a short, slightly winged petiole, coarsely dentate, with spreading teeth, these tipped with a minute callosity, and nearly glabrous above, where the veins are deeply impressed, densely white wooly beneath: panicles wooly, many-flowered, terminal, drooping, about 10 cm. long, compound below, simple above: flowers creamy white, 4 mm. in diameter, on pedicels 4 mm. long, subtended by three short, linear or linear-lanceolate bracts; calyx deeply five-cleft, the lobes ovate-lanceolate; corolla-lobes ovate, concave, thin, veined, very little longer than the calyx; stamens 20, perigynous, three opposite each calyx-lobe, and one opposite each petal, slightly longer than the corolla; styles five, distinct; ovaries woolly. (Pl. 338.)

The type is no. 3840, collected in Santa Fé cañon, nine miles east of Santa Fé, July 12, 1897, altitude 8000 feet. The specimens were taken from bushes which grew some three or four hundred feet up the slope from the stream bed, among basalt rocks, their near neighbors being an occasional pine tree, and scattered bushes of various kinds. The graceful, drooping habit of the panicles cannot be well shown in dried specimens.

The drawing represents a branch one-half natural size; figure 1, a leaf natural size; figure 2, a flower magnified four times; 3, a stamen magnified 7 times, and 4, a pistil magnified 10 times.

Rusby's no. 121, collected on "high summits of Mogollon Mts. N. Mex., Sept. 7, 1881," and labelled "*Spiraea discolor* Pursh, var. *ariaefolia* Wats.," belongs with *H. australis.* It has also been confused with "*Spiraea dumosa*," but is very unlike that species, the type of which is preserved in the herbarium of Columbia University. Its nearest relative is *H. discolor,* a plant of the northwest, the type of which was collected by Lewis "on the banks of the Kooskoosky," Idaho.

GERANIUM ATROPURPUREUM.

Geranium caespitosum A. Gray, Mem. Am. Acad. (II) **4**: 25. 1849. Not James.

Perennial; stalks numerous, 10–30 cm. long, matted together, procumbent or somewhat ascending, divaricately branched, sharply angled and channeled, retrorsely pubescent: stipules lanceolate or triangular-lanceolate, long-acuminate, the lower and broader ones nearly 1 cm. long; leaves orbicular in outline, about 4 cm. in diameter, the basal ones five-parted, those of the stem three-parted, the lateral segments of these again deeply lobed, so as to give them the appearance of being five-parted, the segments all incisely lobed: peduncles slender, 10–12 cm. long, two-flowered, the pedicel of the outer flower 2 cm. long, that of the inner flower a third shorter; sepals 1 cm. long, elliptical-oblong, three-nerved, scarious-margined, tipped with a prominent cusp, pubescent with short, appressed hairs, or sometimes little more than puberulent;

corolla deep rose-purple throughout, the lobes obovate, slightly longer than the calyx, the lower half bearded with straight, white hairs, as is also the lower part of the filament; ovary pubescent; styles 5 mm. long, recurved, spreading in flower.

The description is drawn from our no. 2723, collected along Santa Fé Creek, June to July, 1897. It is very plentiful along the stream, but always in dry ground. It has a range of about 2000 feet, as it was first collected four miles east of Santa Fé, at an elevation of a little over 7000 feet, but later was seen growing on a slope ten miles up the valley, and at an elevation of almost 9000 feet. It was also noticed along the road between Santa Fé and Cañoncito.

This species was described by Gray as long ago as 1849, but he unfortunately referred it to James' plant, and in doing so ran counter to the good judgment of Engelmann. He says: "Dr. Engelmann has indicated it as a new species, but I am so confident that it is the species noticed and imperfectly characterized by Dr. James that I venture to revive his name, which, unless thus identified, must ever remain appended to the genus as a doubtful species, since no specimens of it exist in the collection made by him in Long's expedition."

Why he was "so confident" that he had James' species in hand is not so apparent when one knows the facts, but the citation of "*G. caespitosum* James in Long's Exped. 2. *p. 3*, ex char. et loco natali," seems very conclusive to one who is not in possession of the facts. However, our plant is not the same as James' "ex char." and it is very far from "loco natali." James' description reads as follows: "Sub-erect, pubescent, sparingly branched above. Radical leaves reniform, deeply 5–7-cleft. The flower is a little larger than that of *G. Robertianum* and similarly colored, having whitish lines towards the base of the corolla."

Although the above description is meagre and unsatisfactory, it indicates a plant of different habit and with a corolla of a different color. Whatever points of coincidence there may be between the two plants, there certainly is none in the "loco natali." Part of the Long expedition actually did go as far south as New Mexico, skirting the eastern base of the Rocky mountains, but James was not with this party, and did not go further south than Pike's Peak.

The "Account of an Expedition from Pittsburgh to the Rocky Mountains," under the command of Lieutenant Long, written by Dr. James, is very interesting reading, and there can be no mistaking the approximate locality where he obtained his "*Geranium caespitose*," as it is spelled in the original. In the latter part of volume I. we find an account of their progress up the Platte to and beyond the confluence of the two branches, and their eagerness to ascend the mountains. Finally, having arrived at the foothills, the following account is given:

"The woodless plain is terminated by a range of naked and almost perpendicular rocks, visible at a distance of several miles and resembling a vast wall, parallel to the base of the mountains. These rocks are sandstone, similar in composition and character to that on the Cannon Ball creek. They emerge at a great angle of inclination from beneath the alluvial of the plain, and rise abruptly to an elevation of one hundred and fifty, or two hundred feet. Passing within this first range, we found a narrow valley, separating it from a second ridge of sandstone of nearly equal elevation, and apparently resting against the base of a high primitive hill beyond." At this place, "about the sandstone ledges," is where he collected his *Geranium*, either in what is now the State of Nebraska, or, at most, in extreme northeastern Colorado.

Dr. Trelease, in Mem. Bost. Soc. Nat. Hist. **4**: 75, touched upon this matter, where he says: "There is reason to doubt whether James' plant is not really the preceding (*G. Fremonti*), for he did not collect south of Pike's Peak, while this species, as I understand it, is distinctively southern."

Our plant, so far as I have been able to ascertain, does not occur outside of New Mexico and Arizona, although specimens from several other States, but belonging to some other species, have been referred to it. All the evidence seems to indicate that the real *Geranium caespitosum* is the plant now known as *Geranium Fremonti*, at least so far as applies to the plant collected by Fremont. What Fendler's specimens from "bottom lands of the Mora river," and Lieutenant Abert's from the "Raton Mountains" may be, I do not know, but they are hardly the same as Fremont's specimens, and apparently different from *G. atropurpureum.*

GERANIUM TEXANUM (Trelease)

Geranium Carolinianum var. *Texanum* Trelease, Mem. Bost. Soc. Nat. Hist. **4**: 76. 1887.

Annual; spreading and somewhat ascending, branched from the base and also above, rather stout, 20 cm. high, pubescent with short, appressed white hairs, which point downward: leaves light green, of firm texture, the lower ones on petioles 6–8 cm. long, almost orbicular in outline with rounded sinus, 3 cm. in diameter, three-parted and these divisions again three-lobed, except the lateral or basal ones, the divisions generally oblong, rounded; upper leaves essentially the same, except that the smaller upper ones are more irregular, all appearing as if glabrous to the naked eye, but more or less pubescent with appressed, ascending hairs, especially on the veins and margins: peduncles slender, two-flowered, the lower ones 2 cm. long, the upper ones barely half that length; pedicels slender, 5–8 mm. long; sepals orbicular-ovate, 4 mm. long, 3 mm. wide, three-nerved, one central and prolonged into a prominent cusp, the other two marginal, and marked with a line of hairs; flowers white with a faint purple tinge, the petals entire, oblong or at most obovate-oblong, slightly exceeding the calyx, three-nerved, the veins anastomosing at the top so as to form an open loop; ovary-lobes pubescent with long, scattered hairs; beak slightly over 1 cm. long, short-pointed, hispid with short, ascending hairs: seed ovoid, finely and closely pitted.

Some time ago, while looking over the specimens in the *Geranium Carolinianum* cover at the herbarium of Columbia University, I came across my own no. 1510, collected at Corpus Christi, Texas, in 1894, and at once noticed its dissimilarity to specimens from the Atlantic region. Prof. Trelease kindly loaned me the type specimens of his *Geranium Carolinianum Texanum* for comparison, and I learned that my specimens were identical with his, and quite typical. The specimen from which the above description is drawn is in the Columbia herbarium. The types, which were collected by Lindheimer, near New Braunfels in 1848, are more mature, showing fruit only. My specimens were collected March 27, 1894, in the sandy bed of an "arroyo," a short distance southeast of Corpus Christi, and distributed as *Geranium Carolinianum.* Although related to that species, *G. Texanum* differs in being lower, of a more diffuse habit, the pubescence is of a different nature, the calyx-lobes are broader and shorter, and the petals narrower, not notched, and of a different shape. The leaves also are of a more coriaceous texture.

MENTZELIA PARVIFLORA.

Annual; stems weak, ascending, about 4 dm. high when mature, branching throughout, whitish, shining, sparsely pubescent with short, spreading hairs, or merely glandular puberulent below, leafy, especially above: leaves sessile, the lower oblong, 3–5 cm. long, 5 mm. or slightly more in width, rounded or acutish, the upper ones lanceolate, acute, 2–3 cm. long, less deeply lobed, or some entire, one nerved: flowers axillary, sessile, the lower ones solitary, those higher up often in pairs, and the terminal ones in threes, of these the lateral ones on short branches, thus forming a corymbose cluster, but each individual flower sessile, and subtended by reduced leaves, except the middle one, which is naked; calyx-tube cylindrical, 1.5 cm. long when fully developed, 2 mm. in diameter, pubescent with spreading hairs, which are longer and more plentiful than those on the stems; lobes of the calyx linear-lanceolate, 2 mm. long, pale; corolla expanding in sunshine, pale yellow, spreading, the lobes broadly obovate-spatulate, slightly more than 3 mm. long, and 2 mm. wide at the top, emarginate, veined; stamens shorter than the petals, the filaments all filiform: seeds about 30, in a single series on each placenta, slightly tuberculate scabrous, more or less cubical.

The type is no. 3750, collected eleven miles southeast of Santa Fé, New Mexico, on the road leading to Cañoncito, June 23, 1897, at an elevation of about 7200 feet. The specimens were growing near the roadside, in a day ravine, where they were partly shaded by bushes. Young plants were more simple, and less weak than the older ones, which often grew in clusters, and were somewhat interlaced. In a general way this species is related to *M. albicaulis*, and specimens of it may exist in herbaria under that name, but the flowers are much smaller, in addition to various other differences.

BOISDUVALIA PARVIFLORA.

Small, barely 15 cm. high, branching below, the branches spreading, whole plant pubescent, the hairs white, spreading; lower parts of stem and branches yellowish, and not so densely pubescent as the upper, leafy throughout: leaves lanceolate, the longest about 2.5 cm. long, somewhat narrowed at the sessile base, sparingly glandular, serrate or entire, tipped with a very short cusp, midvein prominent: sepals lanceolate, barely 2 mm. long; the flowers solitary in the axil of nearly every leaf; petals pale red, half again as long as the sepals, obovate-spatulate in shape, two-cleft; mature pods about 7 mm. long, slightly curved outward.

The type is no. 3411, collected July 10, 1896, on the bare, dry ridge east of Lake Waha, Nez Perces county, Idaho, altitude 2500 feet. The plants were growing in dry stony ground. It appears to be a species quite distinct from any hitherto described, although it may have a relative in *B. diffusa* Greene, from near Deeth, Nevada. That species is of different habit, however, and less pubescent.

Erigeron pulcherrimus.

Perennial, from a stout, multicipital rootstock; stems and foliage light green: stems about 20 cm. high, tufted at the base with young leaves and the remains of the old ones, simple, slender, leafy for three-fourths of their length, marked with prominent yellowish lines, pubescent with short, appressed, white hairs, which point upward: leaves all very narrow, about 1 mm. wide, the basal ones linear-spatulate, about 1.5 cm. long, those of the stem 2–4 cm. long, linear, acute, pubescent in the same manner as the stems: peduncles a prolongation of the stems, 2–5 cm. long: heads large, 3.5 cm. in diameter, 7 mm. high; involucral bracts in about four rows, slightly spreading, linear-lanceolate, more or less tinged with red, especially the tips, pubescence spreading; rays 20–30, either white, pinkish, or violet blue, 1.5 cm. long, 2 mm. wide, emarginate. (Pl. 340.)

The type is no. 3664, collected on sandy hills ten miles north of Santa Fé, New Mexico, June 5, 1897, at an elevation of 5800 feet. In the type specimen, the rays are violet blue, but some of the other specimens have pinkish, or even white rays. It is gregarious in habit, and is one of our handsomest species. Its nearest relative appears to be *E. Montanensis* (*E. Tweedyanus*), but it is much less pubescent than that species, the pubescence being appressed instead of spreading, the involucral bracts are longer, more acute, smoother, and the rays are longer and broader. The drawing shows the plant one-half natural size, with a ray flower and disk flower, each natural size.

Hymenopappus arenosus.

Stems several, clustered and united below, from an apparently perennial root 25–30 cm. high, leafy, branching, floccose-tomentose throughout, especially below: leaves light green, thrice, or the upper ones only twice pinnately divided, the divisions all narrowly linear, from .5–2 cm. long, barely 1 mm. broad; basal leaves about 10 cm. long, including a petiole of 5 cm., those of the stems sessile, or the lower one petioled, one springing from the base of each branch, and about the length of the internode which it subtends: heads corymbosely cymose, on rather long, stoutish peduncles (2–6 cm. long), 1 cm. high; flowers bright yellow; bracts of the involucre obovate-oblong, the margins thin, whitish, the middle part green, more or less covered with floccose tomentum, especially at the base; corollas 5 mm. long, the tube occupying nearly half the length, the throat cylindrical rather than campanulate, the triangular-lanceolate lobes little more than one-fourth the length of the throat; akenes villous with rather long hairs; palae of the pappus oblong, or slightly contracted below, a little longer than the corolla-tube.

The type is no. 3542, collected near Española, Santa Fé County, New Mexico, May 17, 1897, at an elevation of 5600 feet. The specimens were growing on the right bank of the Rio Grande, about three miles below Española, in almost pure sand. Later, more of them were noticed on the sand hills at the point where the railroad turns away from the river. It falls into the same group to which *H. flavescens* belongs, but is evidently different. It apparently grows only at elevations under 6000 feet, and at no place was it seen growing in company with *H. luteus* Nutt., which is a perfectly valid species, not at all like any of the so-called forms of *H. filifolius*. *H. luteus* is common on the hills about Santa Fé, growing at an elevation of 7000 feet and more.

UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINN.

New Plants from Wyoming.—I.

By Aven Nelson.

(Plate 341.)

In my work in the Red Desert of Wyoming during part of the season of 1897 a number of rather unusual and interesting plant forms were secured and some plant ranges were greatly extended. To me one of the most interesting finds was a perfectly yellow flowered *Oreocarya*, which may be described as follows:

Oreocarya flava.

Perennial, tufted from a branched, lignescent caudex, 1–2.5 dm. high: stems numerous, simple, white pubescent below, fulvously hirsute upwards: leaves numerous, basal ones scale-like and densely white hirsute, lower stem leaves somewhat crowded, linear to narowly oblanceolate-petiolate, appressed pubescent or hirtellous, upper leaves slightly broader with broader base, 3–5 cm. long: inflorescence crowded, glomerate spicate; calyx yellow-hirsute, lobes linear, half the length of the corolla-tube; corolla a decided yellow, tube about 12 mm. long, lobes suborbicular, 3–4 mm. in diameter, crests conspicuous, emarginate; essential organs strikingly dimorphic; stamens inserted just below the throat or just below the middle of the tube, anthers linear; style the length of the tube or half the length; mature nutlets not seen but seemingly smooth, ovate, one or more sometimes smaller and possibly not maturing.

A remarkably distinct species, not comparable to any form known to the writer. *Krynitzkia leucophaea* Gray may be suggested by it but from that it is more than distinct. In the possession of decidedly yellow flowers it probably stands alone. A beautiful and striking plant as observed on the otherwise often naked hillsides in the Red Desert. Two collections were secured June 1, 1897, one at Point of Rocks, the other at Bitter Creek Station. These differ in that all the specimens in one have long stamens, and in the other they are all short.

Type specimen in Herb. Univ. of Wyoming, no. 3074.

In recent years there has been much seeking after plants that would thrive in soil heavily impregnated with alkali. A number of imported species have been highly recommended and have been tried with varying success. Since those that give greatest promise are species of *Atriplex* it is interesting to find some native species in this genus that look as if they might prove profitable, or at least worthy of trial. These species, one a perennial and the other an annual, both inhabit saline basins or banks even to places actually encrusted with the prevailing salt. They may be named and described as follows:

ATRIPLEX PABULARIS.

Dioecious, perennial, persisting by the very short woody base which branches freely at or just above the surface of the ground; the annual branches numerous and somewhat fascicled, strict and usually but slightly branched, 2–5 dm. high; entire plant with closely appressed white scurf: leaves oblong to almost linear, obtuse, cuneate at base, sessile or very short-petioled, 1–5 dm. long, 1–12 mm. broad: staminate panicle leafy, dense and short (5–15 cm.): pistillate panicle leafy, dense and long (more than half the length of the stem): fruit uniformly triangular-cuneate, decidedly compressed, 4–5 mm. long, almost as broad at summit: bracts united, marginless, the somewhat truncate summit three-toothed, the middle one slightly longer and the lateral ones bearing an inconspicuous rudimentary one; the teeth of the otherwise closely appressed bracts slightly divergent, their sides perfectly smooth, *i. e.*, not crested nor muricate.

From the Desert of Wyoming where it is found in abundance on the highly saline soil of the low flats immediately adjacent to such streams as Bitter Creek and Salt-Wells Creek. It endures the strongest alkali soil, making a dense growth and a large amount of forage which is highly prized as sheep fodder.

In general appearance it most resembles *A. Nuttallii* S. Wats., but is easily distinguished by its less woody base, its denser growth, its more strictly erect habit, its habitat and especially by the very distinct character of its fruiting bracts.

Numbers 3712 and 4429 from Point of Rocks, Wyo., 1897.

ATRIPLEX VOLUTANS.

Annual, silvery-scurfy throughout, divaricately and most intricately branched; branches ascending; the plant at maturity a compact, sub-spherical mass from two-thirds to more than a meter in diameter: tap-root single, slender, brittle at maturity when the plant becomes a "tumble-weed:" leaves comparatively thin, variable in shape, from broadly lanceolate to triangular, rarely sub-hastate or broadly cuneate at base, sometimes irregularly dentate, acute, obtuse or even toothed at apex, sessile or subsessile, 2–5 cm. long: pistillate flowers in axillary clusters: fruiting bracts pedicelled, indurated, united only to the foliaceous margin, irregularly sub-orbicular, 7–14 mm. wide, free margins variously toothed or lobed, the lobes of the opposing bracts not coinciding, the upper lateral usually larger; sides usually appendaged or often only one side giving a triangular appearance to the fruit, appendages frequently somewhat foliaceous and conspicuous; radicle superior. (Pl. 341.)

The species is more nearly related to *A. argentea* Nutt. than any other with which I am acquainted, and possibly has been confused with it. It may be distinguished from *A. argentea* by its habit and size and by its branching bracts. To confuse herbarium specimens of the two would not be difficult, but specimens in the field, never.

So far as my observation goes it is very local. I have observed it for several years past only in a large alkali basin on the Laramie Plains. It is very abundant on the low flats adjacent to some alkali lakes. It grows rapidly, matures in September, and by October most of the plants are free and rolling. I have seen it windrowed against the wire fences to more than the height of the fence, so that the later comers tumbled over and passed on to lodge in some ravine or against the next fence on the route.

The accompanying half-tone plate shows a characteristic specimen with a meter stick lying upon it, and is not unusual as regards size.

Type specimen in Herb. Univ. of Wyoming, no. 2796.

LUPINUS HUMICOLA.

Perrennial; rootstock branched, the low crowns covered with the scale-like dead petioles: stems several from each crown, simple, erect or ascending, 3–6 dm. high; finely but not densely appressed-pubescent throughout: leaflets 7–12, usually 10 or 11, oblong-oblanceolate, cuspidate-acute, 4–7 cm. long: petioles slender, elongated, radical 1.5–3 dm., cauline gradually shortened upward: stipules linear-lanceolate, villous: racemes terminal, dense, 1–2 dm. long, elongating in fruit: flowers blue, sub-verticillate, standard glabrous; bracts minute or wanting; pedicels 5–8 mm. long, stout in fruit: pods villous-pubescent, 2.5–4 cm. long, normally 6-seeded.

A good species, possibly somewhat local; abundant in the Laramie hills, where it has several times been collected and frequently observed. It has not been secured elsewhere in the State. It loves a moist soil, rich in humus; is not found on the open plain but in aspen or other thickets or even among sage-brush on the slopes where snowdrifts accumulate and lie late in the spring. It develops early, almost out of the snow-drifts, and begins to show its spikes of blue even before the aspens are in leaf.

Heretofore carelessly confused with *L. leucophyllus* Dougl. under which name I have distributed it as no. 151.

Type specimens in Herb. Univ. of Wyoming, no. 151, Laramie Hills, June 2, 1894, and no. 71, a well-fruited specimen from the same locality by Mr. Elias Nelson, who first called my attention to the marked differences between these specimens and *L. leucophyllus.*

LESQUERELLA CURVIPES.

Perennial: stems tufted on the expanded crown of the single, long, slender, woody root, numerous (30–60), nearly simple, spreading-assurgent, 1 ½–3 dm. long; finely stellate pubescent throughout: leaves entire, cauline, linear to oblanceolate, tapering gradually into the somewhat margined petiole, 3–6 cm. in length, radical oblanceolate to obovate with margined petioles: flowers unknown: pods ovate, acute, distinctly compressed at summit, gibbously convex towards the base, about 8 mm. long, the slender style two-thirds as long: slender pedicels divaricate, 1–2 cm. long, doubly curved, the proximal part upward, the distal downward with ascending tip bearing the erect pod: seeds two in each cell, rarely one or three.

It most resembles *L. montana* Nutt. from which it differs in its larger size, more numerous stems, its somewhat veiny leaves, larger, compressed pod and fewer seeds.

Collected in the northern Big Horn Mountains, on the Dome Lake road, at about 9000 ft., July 19, 1896, no. 2424.

LESQUERELLA ROSULATA.

Annual, or possibly more enduring, finely stellate pubescent throughout: stems few, 1–2 dm. long, ascending, floriferous one-half their length: leaves mostly radical, forming a compact rosulate cluster on the crown of the short tap-root, outer ones large, blade 3 cm. long on petioles 3–6 cm., diminishing in size and length of petiole towards the center, oval to oblong, entire or tooth-angled, some of the smaller sub-hastate, cauline only one or two, oblong, 2–3 cm., petioled: pods oval to elliptic, sub-acute or more usually obtuse, 5–6 mm. long, slender style as long or longer: pedicels ascending, curved, about 1 cm. long.

Perhaps most closely allied to *L. montana* Wats. by its fruit, but separated from it by its conspicuous rosette of basal leaves, its fewer stems, its few, long-petioled cauline leaves, its smaller pod and its later development. *L. montana* matures its fruit in June; this species in late August.

Centennial Valley, on loose sandy soil, August 18, 1896.

A new Atriplex.

By George E. Osterhout.

Growing in the saline soil of the elevated table-lands of Colorado and Wyoming is a small shrubby *Atriplex*, which appears to be undescribed, and to which I assign the name

Atriplex fruticulosa.

A scurvy canescent decumbent shrubby perennial, 2–4 dm. in length, the ends of the branches ascending and the annual growths for the most part bearing the flowers and fruit. Leaves spatulate to oblanceolate, nearly sessile, obtuse or subacute at the apex, narrowed from above the middle to the base, 3–6 mm. wide by 1.5–3 cm. long, with many smaller leaves toward the base: flowers dioecious, both kinds in capitate clusters from the axils of the upper leaves: staminate branches often becoming spicate, and the flowers often brown in color, about 10 in a cluster: pistillate flowers green, and about 5 in a cluster; bracts of the pistillate flowers oblong, united to the top, 2 mm. wide by 3 mm. long; fruiting bracts oblong, 3–3.5 mm. wide by 5–6 mm. long, a little broader at the top, rounded at the base, usually 3-toothed at the apex, with the middle tooth largest; the sides are smooth and reticulated; radicle pointing upward.

The type was collected in July, 1896, near a small alkaline lake in southern Wyoming. Other plants which I collected in the same locality and in North Park, Colo., in September, 1897, are quite surely this species, but differ from the type in that the fruiting bracts are irregular, and some of them more or less muricate. On examination it was found that few of them had perfected seed, having suffered from the depredations of some insect, which probably accounts for the irregularity of the bracts. It was also collected by Mr. P. A. Rydberg near Green River, Wyoming, in July, 1895. I am indebted to Mr. Rydberg for comparing my specimens with those in the herbarium of Columbia University.

Some rare Washington Plants.—II.

By K. M. Wiegand.

In the July 1897, number of this journal the writer published a short list of rare plants collected by Mr. J. B. Fleet in various portions of the state of Washington. Since that time a large set of about two hundred numbers collected by the same person has been received. The collecting ground this time covered two distinct localities. The first, situated on the shores of Puget Sound, in the vicinity of Whidbey Island and Hadlock, Wash., was distinctly littoral in character. On the contrary, the other was alpine, located as it was near the summit of the Olympic Mountains, on the watershed between the Dungeness and Quilcene Rivers. As one might naturally expect, the rare plants in the Sound collection were few and mostly introduced. On the other hand and quite in contrast with this, the set from the mountains was unusually rich in forms that from their known distribution seem out of place. Those which from the literature at hand, seem to be rare or to extend the known range of the species are included in the following list.

Anemone multifida Poir. Grassy slopes near the summit of the Olympic Mountains. Alt. 6000 ft.

Delphinium glaucum Watson. Moist grassy places near the summit.

Delphinium bicolor Nutt. Dry grassy slopes near the summit.

Draba Lemmoni Watson. Rocky places near the summit.

Draba stenoloba Ledeb. Among stones and rocks, mountain summit.

Viola Howellii Gray. Shady places near Puget Sound.

Lewisia Columbiana (Howell) Robinson. Rocky ledges, summit.

Potentilla villosa Pall. Rocky ledges, Olympic Mts. Alt. 6000 ft.

Hippuris vulgaris L. Whidbey Island, Puget Sound.

Epilobium glaberrimum latifolium Barby. Moist grassy places, summit of the mountains.

Lonicera Utahensis Watson. Rocky ledges and ravines near the summit.

Galium trifidum subbiflorum Wiegand. Lake shores and pools about Puget Sound. Specimens previously examined showed the range of this variety west of the Rocky Mountains to extend no farther north than Oregon, but the numerous specimens in the present collection extend the range at least as far as Puget Sound; doubtless it grows still farther north.

Artemisia borealis Wormskioldii Bess. Rocks and loose stones, summit.

Sonchus arvensis L. Whidbey Island, Puget Sound.

Campanula scabrella Engelm. Rocks near the summit.

Gentiana acuta Michx. Hadlock, Wash.

Rhinanthus Crista-Galli L. Whidbey Island, Puget Sound.

Orthocarpus tenuifolius (Pursh) Benth. Rocky ledges near the mountain summit.

Abronia latifolia Esch. Whidbey Island.

Polygonum Austenae Greene. Grassy slopes near the summit.

Salix commutata Bebb. Moist grassy places, springs and streams near the summit. In flower July 27.

Allium cernuum Rothr. Rocky ridges and dry ground, summit.

Zygadenus elegans Pursh. Rocky ledges, summit; fine specimens; the obcordate glands, large flowers and broad sepals are very conspicuous.

Carex exsiccata pungens Bailey. Swamps about Puget Sound.

Carex nardina Fries. Loose rocks and gravel. Alt. 6000 ft.

Polypogon littorale Smith. Salt marshes, Puget Sound.

Aira Caryophyllea L. Prairies near Puget Sound.

Lycopodium lucidulum Michx. Snoqualmie, Cascade Mts.

CORNELL UNIVERSITY.

Notes on Maine Plants.

BY F. L. HARVEY.

The following notes may be of interest to botanists. The species are either new to the State or the localities are new. The grasses were examined by Mr. Scribner.

BRASSICA JUNCEA (L.) Cosson.

Orono, July, 1896. Cultivated fields (Harvey).

DIANTHUS BARBATUS L.

Orono, July, 1896 (Harvey), E. Auburn, July, 1896 (E. D. Merrill). Growing in grassy places near gardens and maintaining itself from year to year.

GERANIUM BICKNELLII Britton.

Common about Orono in rocky woods along roadsides, July, 1896 (Harvey). This species seems to be more common in Maine than *G. Carolinianum*, with which it has been confounded.

AGRIMONIA HIRSUTA Bick.

Auburn and Monmouth, July, 1896–7 (E. D. Merrill).

SPIRAEA FILIPENDULA L.

Machias, Me., Aug. 1897. Common along stone walls by the roadside (P. L. Ricker).

RUBUS SETOSUS Bigelow.

Auburn, July, 1896 (E. D. Merrill).

CHRYSANTHEMUM VALSOMITA TANACETOIDES Boiss.

Roadsides and waste heaps, E. Auburn (E. D. Merrill). Escaped from gardens.

LACTUCA GRAMINIFOLIA Mx.

There is a specimen of this species in the Blake Herbarium Univ. of Maine collected at N. Bridgton, Me., July 1873, by Rev. J. Blake.

AMARANTHUS BLITOIDES S. Watson.

Common in car-yards, Bangor, Me., July, 1895. (Harvey.) The plants are depauperate.

CUSCUTA EPITHYMUM Mun.

Common in clover fields, Bradley. (Harvey.) Parasitic on red clover.

CAREX MONILE MONSTROSA Bailey.

Bank of Stillwater River in low ground, Orono, July, 1896. (Harvey.) According to Britton this plant has only been found heretofore along the Concord River in Massachusetts.

CAREX BIGELOVII Britton.

Black Cap Mountain, Amherst, Aug. 1896. (Harvey.)

PANICUM IMPLICATUM Scribner.

We think this is a form that has been confounded until recently with *P. pubescens* Lam. and *P. lanuginosum* Ell. E. Auburn, 1896. (E. D. Merrill.)

PANICUM LINARIFOLIUM Scribner ined.

Orono, July, 1890. (Harvey & Briggs.) E. Auburn, June, 1896. (E. D. Merrill.) This form has been confounded with *P. depauperatum* Muhl. until recently.

PANICUM BOREALE Nash.

Chemo Stream, Bradley, July, 1891. (F. P. Briggs.) Monmouth, July, 1896. (E. D. Merrill.)

PANICUM MACROCARPON Torr.

Roadsides, E. Auburn, June, 1896.

PANICUM DICHOTOMUM ELATUM Vasey.

July, 1881, Wells. (Rev. J. Blake.) This forms occurs in the Blake Herbarium as *P. dichotomum* type.

AGROSTIS NOVAE-ANGLIAE Tuckerm.

There is a specimen of this species in the Blake Herb. of the University of Maine, collected by Rev. J. Blake, Aug., 1871, at Wells, Me., and incorrectly named *A. perennans*. This was found at E. Auburn in 1896 in low grass land by E. D. Merrill.

AGROPYRON REPENS GLAUCUM Scribner.

Common about gardens, Orono, 1895. (Harvey.)

Proceedings of the Club.

WEDNESDAY EVENING, JANUARY 26, 1898.

There were nineteen persons present with President Brown in the chair.

In accordance with notice given at the preceding meeting, the amendment to the Constitution proposed in December was called up and passed, changing the limit of associate editors of the BULLETIN to seven instead of five.

Mr. Marshall A. Howe was elected associate editor.

An invitation from Prof. F. E. Lloyd to meet at Teachers College on the first session in March was referred to the Committee on Program with power.

The first paper, "New Sapindaceae from South America," was by Dr. Radlkofer, of Munich, and presented by Prof. Burgess. It contained descriptions of species of *Urvillea*, *Serjania* and *Paullinia*, soon to be printed in the BULLETIN. Their type specimens were exhibited, forming part of a collection made by Dr. Rusby in South America.

The second paper, by Dr. J. K. Small, "The genus *Bumelia* in the Southern States," described the distinctive characters of thirteen species, five of which had been before recognized.

Discussion on specific limitation followed, President Brown, Dr. Britton, Dr. T. F. Allen, Dr. Small, Dr. Underwood, Prof. Lloyd and the Secretary participating.

Dr. Britton spoke of cultivation in the Botanical Garden at Bronx Park, as having already settled some questions of specific limits. Mr. Nash has in this way proved *Potentilla Canadensis* and *P. simplex* to be distinct, also the European *Pyrola rotundifolia* and the American species long known under this name.

The third paper was by Dr. N. L. Britton, "Remarks on some species of *Senecio*," with exhibition and discussion of illustrative specimens, and of several new species, soon to be printed. One species from White Sulphur Springs is one of three plants on

Kate's Mountain which find their nearest relatives on the Rockies 1500 miles distant.

Discussion followed on the respective value to be assigned to different characters. Dr. Britton held that absence of rays is an uncertain distinction in *Senecio* and that involucral characters are more permanent. The Secretary remarked on the failure ot acheneal characters in *Aster*, and Dr. Britton upon the same in *Helianthus*.

Prof. Lloyd remarking that *a priori* we should expect to find greatest variation in organs like leaves which are in direct contact with their environment, Dr. Britton said that though leaves vary much in form, they vary but little in assimilation-tissue, their special character.

TUESDAY EVENING, FEBRUARY 8, 1898.

Twenty-seven persons were present, President Brown in the chair.

The program was devoted to the Asclepiadaceae or milkweed family.

The first paper was by Dr. H. H. Rusby, describing "A new Genus of Asclepiadaceae from Bolivia." Dr. Rusby discussed the tribal and generic characters of that family, and exhibited specimens of his new genus, which is a vine of vigorous growth and of peculiar pollinial position.

The second paper, by Miss Anna M. Vail, described a new species of *Acerates*, or green-milkweed, with comparisons of the other species already known. Specimens and illustrations were exhibited, with remarks upon the history of the genus from its earliest species, *A. Floridana*, onward. As distinctive characters of *Acerates*, she mentioned its aspect, its form of hood and its lack of strong horn-like characters. The characteristics were further discussed by Dr. Edward L. Greene, who was present from Washington, and who emphasized the importance of its axillary subsessile umbels and the green color in its flowers.

The varieties of *Acerates viridiflora* were then discussed, especially with reference to their great difference in leaf-form. Miss Vail finds their flowers to be identical. Mr. Rydberg reported finding all four of these forms within one county of central Nebraska on the sandhills, but to the east the broader-leaf only, and in Western Nebraska a narrow-leaf variety only.

General discussion on the Asclepiadaceae followed, participated in by Prof. Greene, Dr. Britton, Dr. Rusby and others. Miss Vail, in answer to inquiries, indicated the difficulties in the way of regarding the horn in that genus as a midrib. It is very variable, often double, differs in character from the still persistent midrib of the same hood, and in many western species is replaced by a broad triangular lamina.

Miss Vail described her results when watching plants of *Asclepias Cornuti* last summer. Bees and many small insects directed themselves at once to the glutinous top of the anther-column. They seemed to neglect the corona, and but little secretion was apparent in it, instead of the copious deposits of honey expected.

Prof. Greene queried if the corona in this family might not prove to be the true corolla, and cited the Malvaceae as similar in adhesion of the corolla to the stamen-tube. He said, I would exclude from *Asclepias* every species which does not develop a terminal umbel. The only invariable character by which I would distinguish *Asclepias* and related genera is found in the anther-wing. The first index to a new genus is its aspect. It is the part of the systematic botanist to define, if possible, what the significant elements of this habit or aspect are. Habit is often strongly marked even where clearly accented characters are difficult to find. It is a nice genus which has both habit and clear characters.

Dr. Britton followed with description and exhibition of a new salt marsh *Scirpus*, or bulrush, from Connecticut, related to *S. robustus* of Pursh, but with different inflorescence and achene.

Dr. Britton also presented specimens of *Triosteum angustifolium* from Stratford, Conn., its previonsly-known stations northeast of Pennsylvania being only at New Brunswick, N. J., and Glen Cove, L. I. A large supply of roots from Stratford are now planted at the Botanical Garden to exhibit development.

WEDNESDAY EVENING, FEBRUARY 23, 1898.

This meeting was held in the large lecture hall of the College of Pharmacy and about 150 persons were present, with Vice-President Rusby in the chair.

Arrangements were announced for summer courses in Botany, provided by the Committee of Instruction of the club. Course 1 to commence March 4, at the College of Pharmacy under Mr. W. A. Bastedo, with weekly lectures and excursions on Saturdays.

Pursuant to motion of Dr. Britton, the Chairman made this evening the announcement of the Field Committee for the year 1898, to consist of three members, with power to add to their number. The committee was announced to consist of Mr. W. N. Clute, Chairman, Prof. F. E. Lloyd and Mr. W. A. Bastedo.

The evening was devoted to an illustrated lecture by Mr. Cornelius Van Brunt on the wild flowers of the Canadian Rockies, with lantern slides exquisitely colored from nature by Mrs. Van Brunt. Numerous views of the scenery of their surroundings were shown, especially of the Selkirk mountains and about Banff. Here instead of *Rudbeckia* and *Leucanthemum*, *Gaillardia aristata* covers the fields with multitudes of purple and yellow flowers. Vetches are numerous; blue clover (lucerne) takes the place of red; turf for the lawns is composed of buffalo clover only (*Trifolium reflexum*). Beautiful examples of *Hedysarum*, *Lathyrus* and *Oxytropis* occur, among the Leguminosae, *Linnaea borealis*, *Potentilla fruticosa* and several species of *Allium* were abundant, also *Parnassia palustris* and *P. fimbriata.* Near the hotel at Banff great numbers of *Shepherdia* bushes are hung with their red berries. The red berry-like fruit of the strawberry-blite, *Chenopodium capitatum*, was seen in great abundance in parts of the Canadian National Park, as was *Galium boreale*, *Anaphalis margaritacea* and several species of *Gentiana* and *Pedicularis.* The asters were represented by *A. Fremonti;* instead of the dandelion, *Troximon*, with similar blossoms, had become the most common flower; myriads of hare-bells, apparently *Campanula rotundifolia*, dotted the roadsides, and the horse if left to himself would hunt them out as the choicest eating. One field was a beautiful mass of squirrel-grass, *Hordeum jubatum;* larkspurs grew all along the road; blue flax (*Linum perenne*) and *Rosa acicularis Bourgeana* were still in blossom. About the numerous hot springs and ponds formed from them grew plants of warmer latitudes, here blooming early, as

Gentiana detonsa in July. *Lobelia Kalmii* was blooming in the hot water. Many parts of this park have lost their beauty from the continuous forest fires. The Canadian Pacific Railroad employs watchmen whose sole duty is to guard against these fires. Digging shows that such fires have ravaged this region since times before history. The blackened ground is slowly covered by fireweed (*Epilobium angustifolium*), and, after the charred trees have fallen, by vigorous young growth of balsam spruce and pine. The abundant painted-cup disputes with the fireweed the position of the most showy flower of the region. An interesting visit to Lake Louise and neighboring glaciers was described, also to Mirror Lake, with altitude of 6480 feet. Great numbers of crossbills were met near the glacier, feeding upon pine-cones; three columbines, *Aquilegia*, were close to the snows, with *Ledum latifolium*, *Penstemon Menziesii*, *Valeriana Sitkensis* and *Arnica cordifolia*. *Habenaria hyperborea* was everywhere through the woods. The moss-campion, *Silene acaulis*, covered dry rocks, with long tap-root going down three feet or more to water. Strangely enough, the night-flowering catch-fly, *Silene noctiflora*, was here in force. *Bryanthus* and *Cassiopea* were in fine flower. Lyell's larch grew higher up the mountains than any evergreen, and its bright green was already turning now in August to its autumn yellow.

After thanks to Mr. Van Brunt for these results of his summer in the Rockies, the club adjourned.

EDWARD S. BURGESS,
Secretary.

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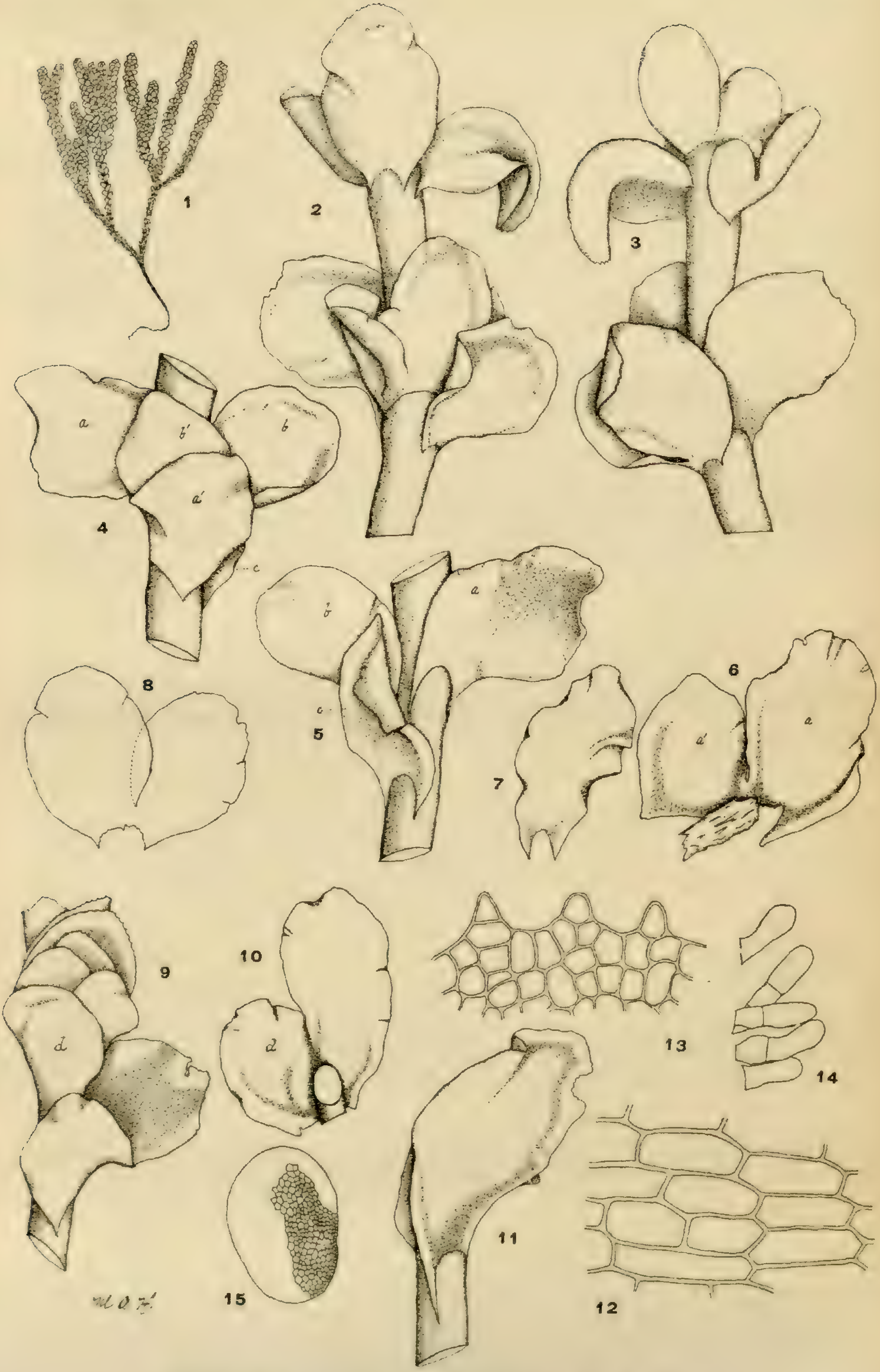
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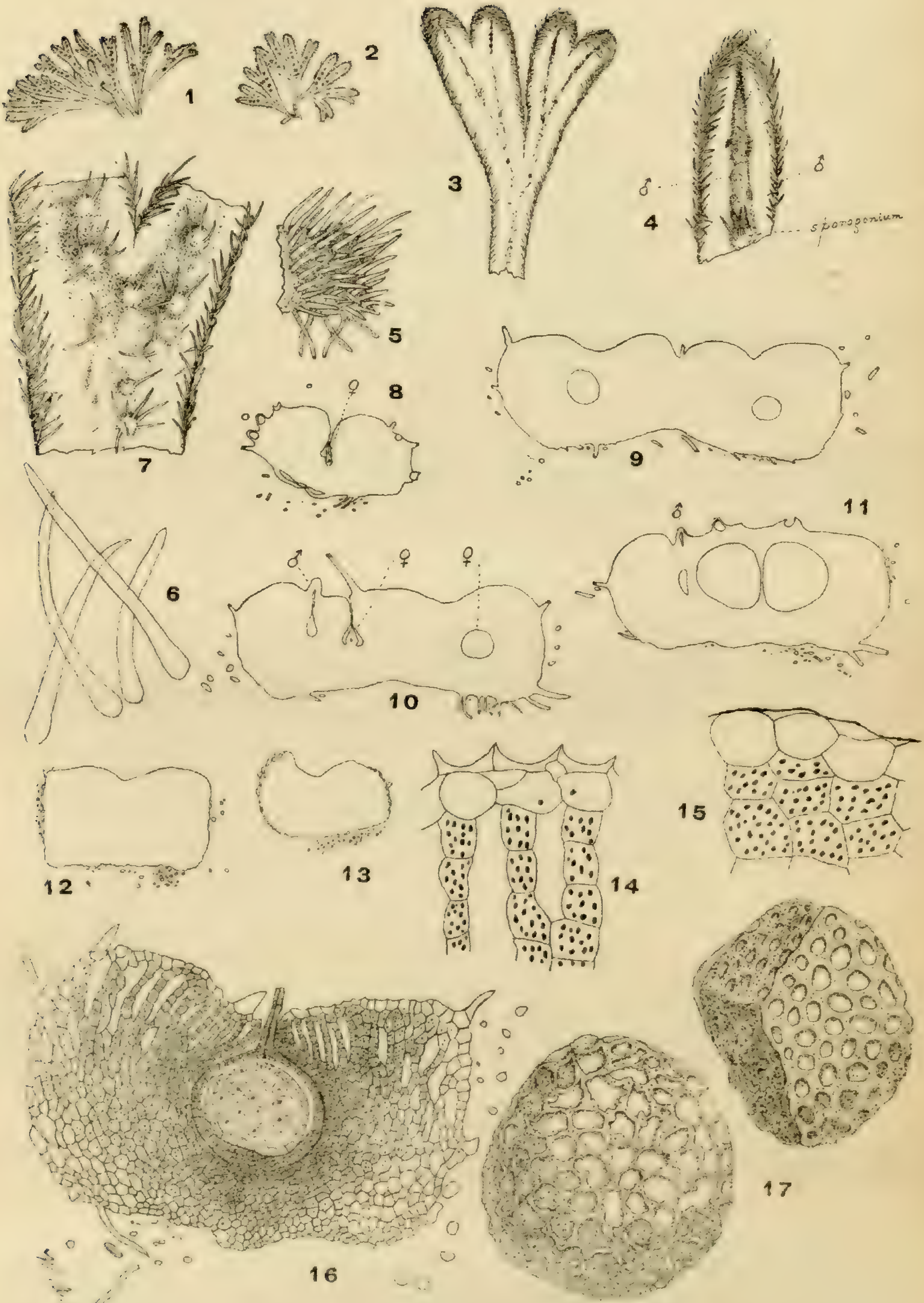
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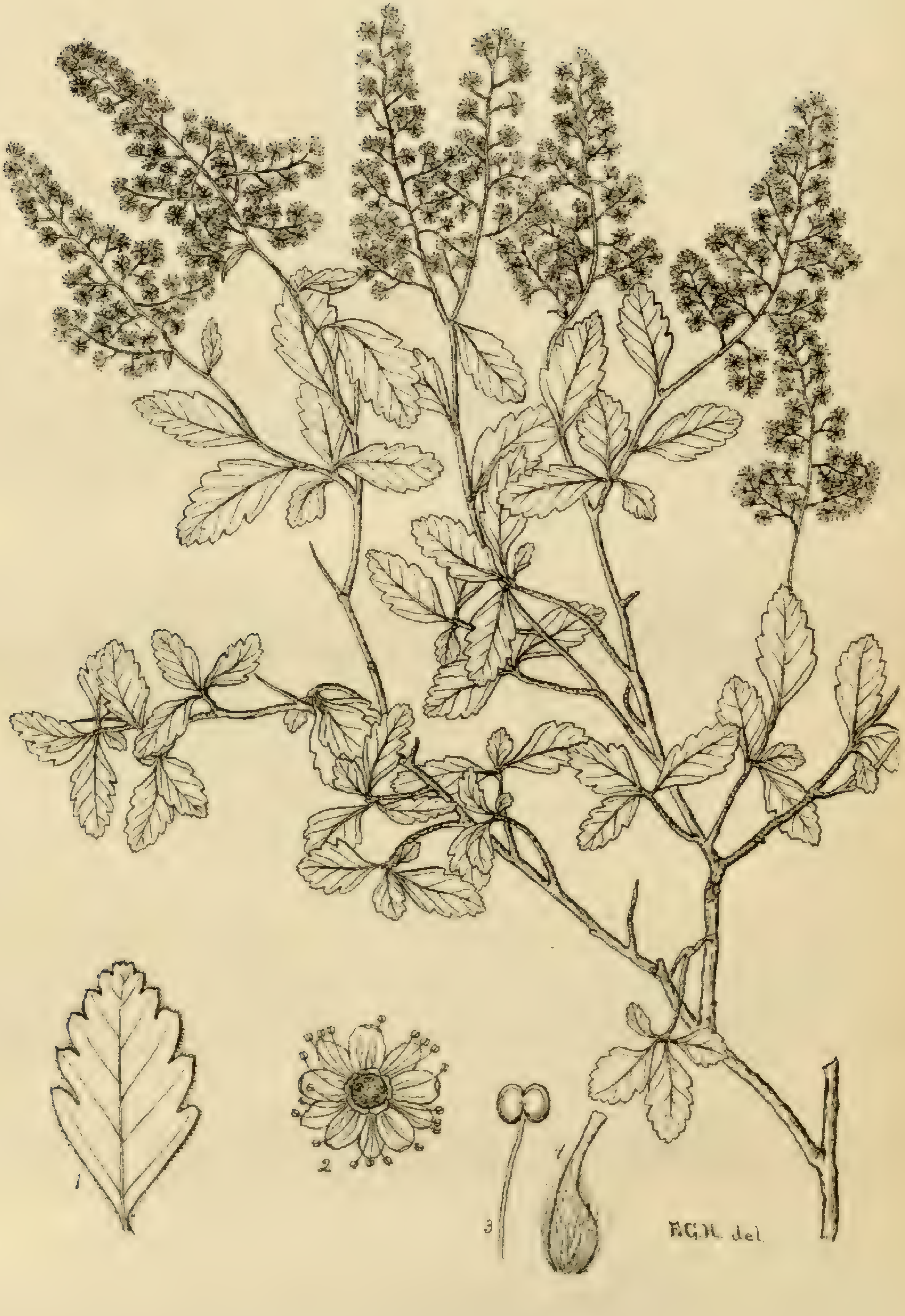
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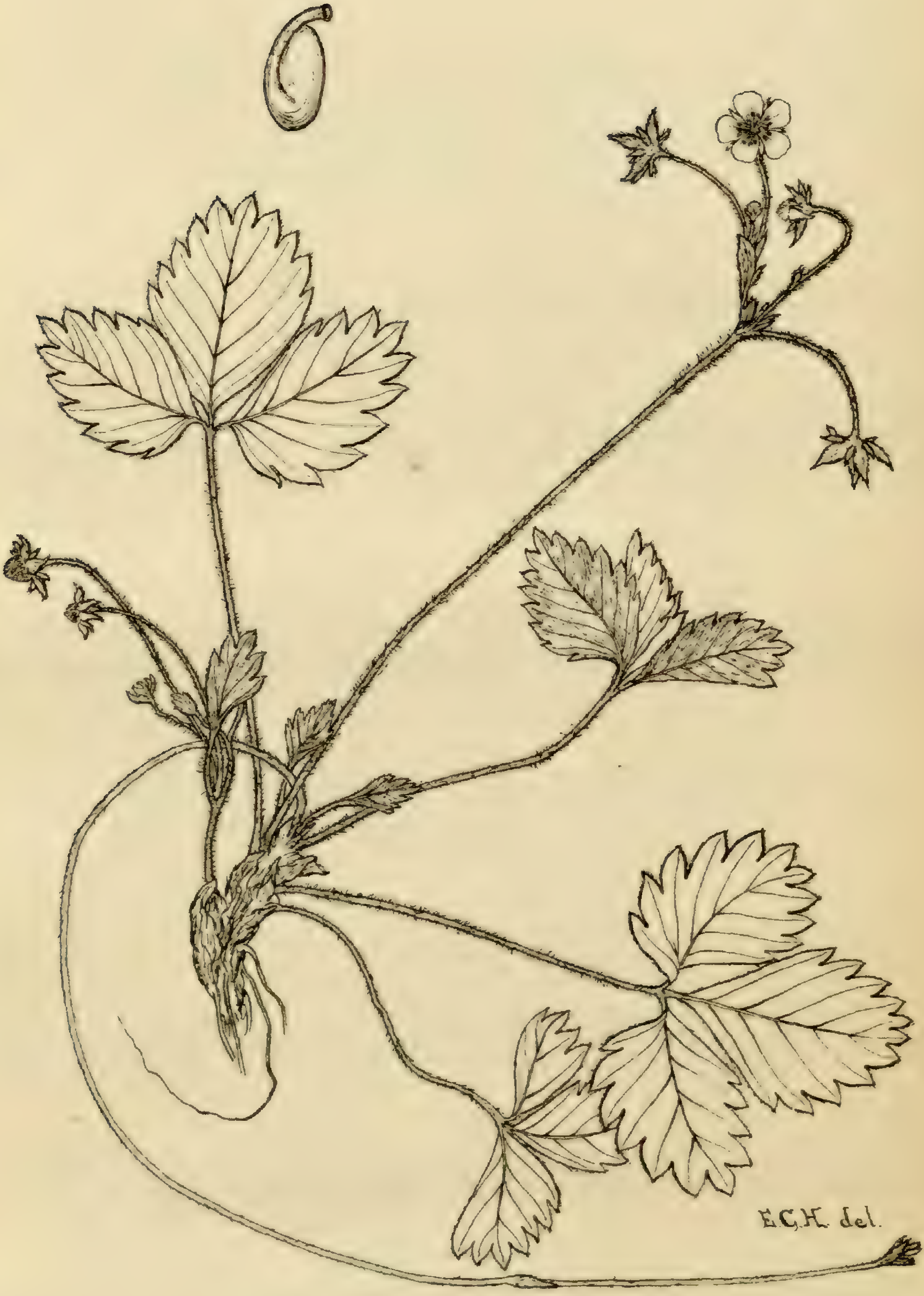

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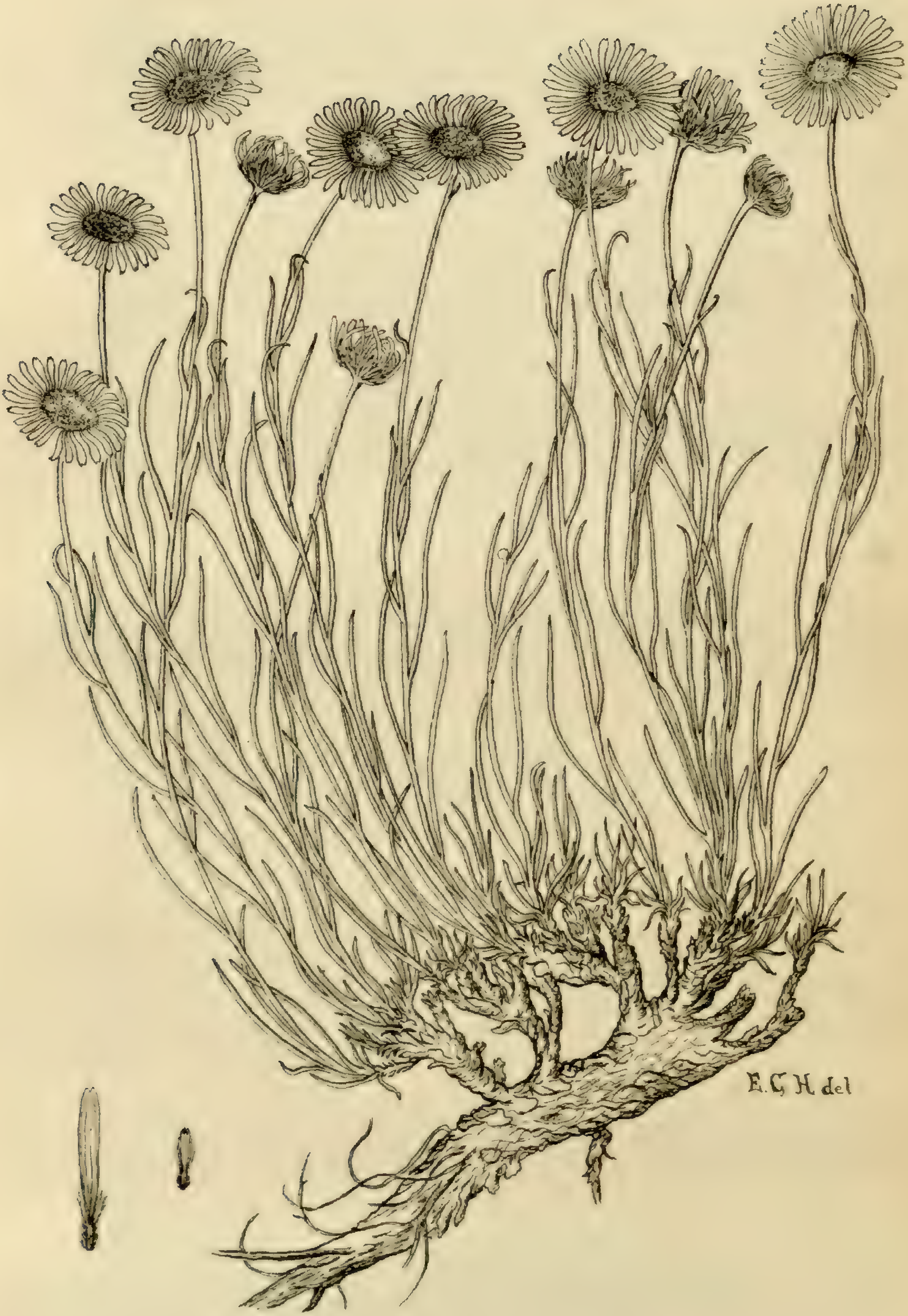

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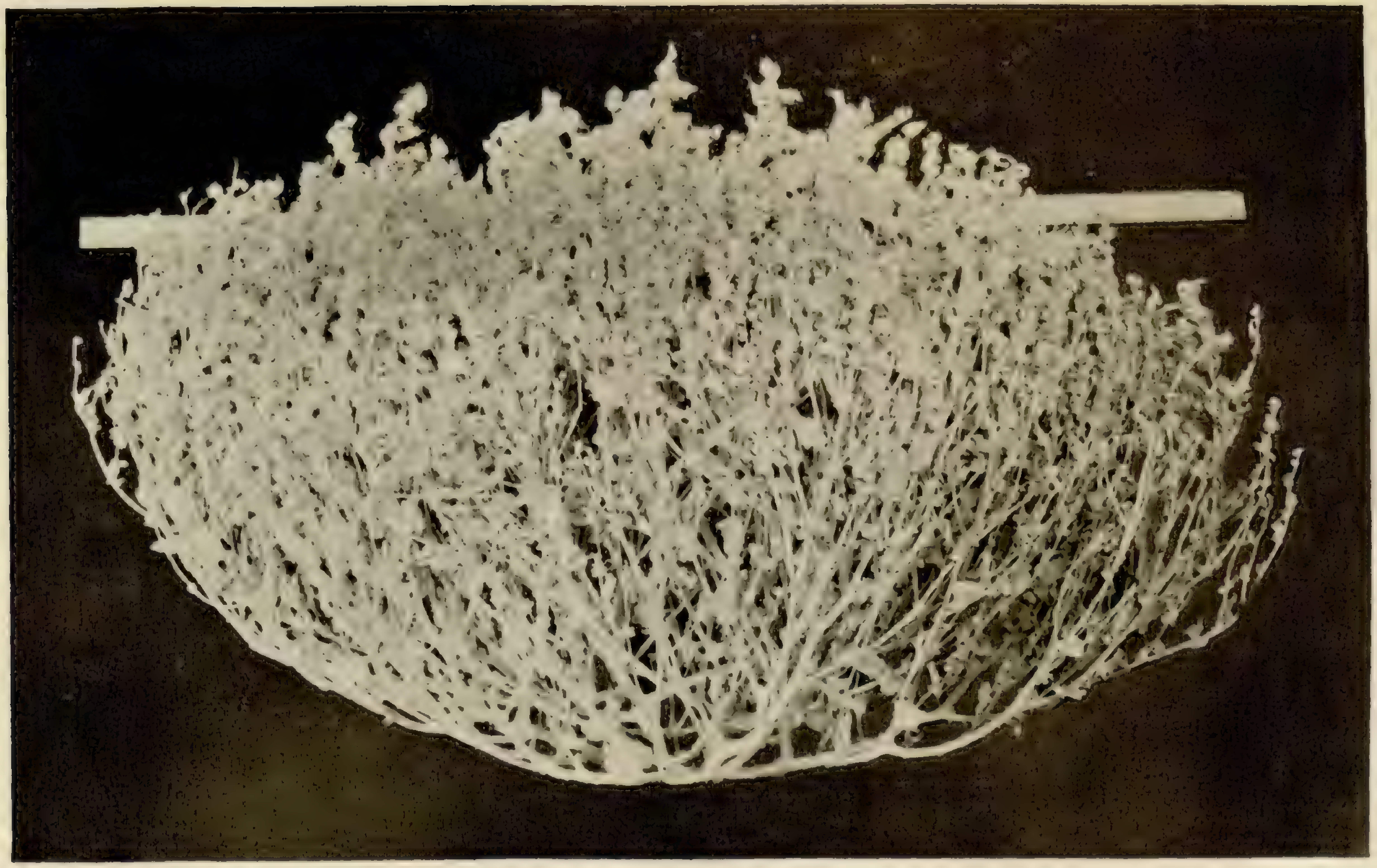

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OF THE

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MAY 1898

A Revision of the North American Eurhynchia.

By A. J. GROUT.

A careful study of the North American species ordinarily referred to the genus *Eurhynchium*, so far as represented in the herbaria of Columbia University, the University of Wisconsin, the National Museum, the collections of Prof. John Macoun, and some private herbaria, together with selected specimens from the herbarium of Harvard University, have convinced me that the relationship of these species will be better represented by referring them to more than one genus.

I take pleasure in acknowledging my obligations to Prof. L. M. Underwood, Mr. F. V. Coville, Prof. C. R. Barnes, Prof. John Macoun, and Dr. B. L. Robinson for specimens loaned. I am also greatly indebted to Mr. H. N. Dixon for valuable notes on *E. praelongum*, *E. hians*, and *E. Stokesii*, and for a large number of English specimens of the same; also to Dr. G. N. Best and M. Jules Cardot for various notes and specimens. Mrs. E. G. Britton and Mr. M. A. Howe have frequently assisted me by valuable suggestions, and by looking up references and revising manuscript.

Leaves papillose by the thickened angles of the cell walls; leaf cells 8–15 : 1. *Bryhnia.*

Leaves very slightly or not at all papillose; leaf cells 4–6 : 1.
    Leaves very concave, cochleariform, abruptly long filiform-acuminate. *Cirriphyllum.*
    Leaves plane or slightly concave, not cochleariform; branch leaves acute to acuminate. *Eurhynchium.*

[Issued 12 May.]

CIRRIPHYLLUM gen. nov.

Gametophyte very robust, glossy, growing on earth and rocks, occasionally on roots of trees; stems possessing a well differentiated central strand, prostrate or creeping, irregularly or subpinnately branching, branches julaceous, terete-foliate. Leaves imbricate, *very concave, spoon-shaped, rounded and often cucullate at apex, abruptly drawn out into a long filiform acumination*, costate to the middle or beyond; median leaf-cells linear, 10–15 : 1; basal broader and shorter; alar often quadrate. *Sporophyte* as in *Brachythecium* except that the operculum is usually long-rostrate.

The plants referred to this genus certainly have no closer genetic relationship with those retained to represent *Eurhynchium* than with several other genera. The rostrate operculum is the only character which would link the two in one genus. Lindberg transferred the European representatives of this genus to the division *Rhynchostegium* of the genus *Hypnum*, while Kindberg places them all in *Brachythecium.* The gametophyte characters of several species are certainly more like *Brachythecium* than *Eurhynchium.* The resemblance between *C. Tommasinii* and *Brachythecium albicans* is certainly very striking, and robust forms of the latter have been taken for the former. Consequently it seems far more satisfactory to constitute the following species a separate genus, far better characterized than many of the allied genera, also more distinct and more homogeneous. Some of the species here referred to *Cirriphyllum* have been referred to *Myurium*, but the fact that the leaves of the species upon which the genus was founded, *M. hebridarium* Schimp, are ecostate seems to be sufficient proof that it is not congeneric with any of the following species.

Leaves with a very long filiform acumination.
  Apex of branch leaves strongly cucullate at base of the acumination.
    High alpine mosses growing on stones; costa of stem leaves very short. 1. *C. cirrosum.*
    Lowland mosses growing on the ground and roots of trees; costa of stem leaves extending $\frac{2}{3}$ their length. 3. *C. piliferum.*
  Apex of branch leaves not cucullate at base of acumination.
    Acumination 0.3–0.4 mm. long; median leaf-cells 3–4 : 1. 2. *C. Brandegei.*
    Acumination 0.5–0.8 mm. long; median leaf-cells 8–12 : 1. 1a. *C. cirrosum Coloradense.*
Leaves shorter acuminate, apex twisted. 4. *C. Boscii.*

1. CIRRIPHYLLUM CIRROSUM (Schwaegr).

Hypnum cirrosum Schwaegr. Schulte's Reise auf d. Glockner, 365. 1804.

Brachythecium cirrosum Schimp. Syn. Ed. 1 : 696. 1860.

Eurhynchium Vaucheri var. *julaceum* Br. & Sch. Bryol. Eur. fasc. 57–67, *pl. 530.* 1854.

Myurium (?) *Herjedalicum* Schimp. Syn. Musc. 696. 1860 (*fide Juratzka*).

Eurhynchium cirrosum Husnot, Musc. Gall. 338. 1893.

Gametophyte in bright glossy yellow-green mats; primary stems creeping, irregularly branching; branches 5–10 mm. long, julaceous; branch leaves appressed-imbricate, decurrent, oblong-ovate, not including acumination 1.3 × 0.65 mm., entire or serrulate above, abruptly narrowed to a filiform acumination which is serrulate to nearly entire, 0.5 mm. long, concave and spoon-shaped, cucullate at base of acumination; margins somewhat reflexed below; costa short, extending from 1/3–1/2 length of leaf, sometimes divided or branching; median cells 10–12 : 1; alar quadrate to hexagonal, indistinct; stem leaves ovate, body of leaf 1.8–2.4 mm., acumination 0.6–1 mm. long, area of quadrate-hexagonal alar cells much larger; costa very short, median leaf-cells somewhat shorter: dioicous; perichaetial leaves ecostate, serrate at apex, abruptly narrowed into a long filiform squarrose serrate acumination. *Sporophyte* 15 mm. high; seta twisted to the right, rough with blunt papillae; capsule ovoid, unsymmetric, horizontal, with operculum 2 mm. long, 2–1, chestnut-brown, not contracted under the mouth when dry; operculum sharply conical, not rostrate; annulus* not highly differentiated, segments split between the articulations; cilia 2, strongly nodose; spores 18–20 μ, finely roughened.

Sporophyte not yet reported from America. Description of sporophyte adapted from Limpricht, Rab. Krypt. Fl. 4^3: 183. 1897.

Growing on rocks in mountains. Colorado, Brandegee, Wolf & Rothrock; Pike's Peak, Mrs. S. B. Clark, J. M. Holzinger.

Type locality, European.

ILLUSTRATIONS. Br. & Sch. l. c; Husnot, Musc. Gall. *pl. 97;* Limpricht, Rab. Krypt. Fl. 4^3 *f. 386*; Dixon & Jameson Handb. Brit. Mosses, *pl. 53, f. G.*

---

* Mrs. Britton, March, 1897, in specimens collected in Algau by Molendo (Herb. Jaeger), found the annulus to consist of 3 rows of very irregular and persistent cells.

Our American specimens are less robust and shorter stemmed than most of the European material at hand and the stems are not stoloniferous or the branches flagelliform as is usually the case with European specimens, yet some European plants agree almost exactly with the American plant and the two are almost certainly the same species. *C. cirrosum* is a very variable and poorly understood plant even in Europe.

1a. CIRRIPHYLLUM CIRROSUM COLORADENSE (Aust.).

Hypnum Coloradense Aust. Bot. Gaz. **2**: 111. 1877.

Gametophyte robust; stems 3–5 cm. long, erect or at length prostrate, sparingly branched; leaves loosely imbricate, oblong-ovate, 2–2.2 × 0.9 mm. without the acumination, which is 0.5–0.8 mm. long, nearly entire, abruptly long filiform acuminate but not at all cucullate, much less concave than in the typical form, somewhat plicate.

Type locality, Alma, Park Co., Colorado, Miss H. J. Biddlecome. Type in the herbarium of Columbia University.

Distinguished by the stout, sparingly branched stems and loosely imbricate leaves which are not cucullate at apex. It does not correspond with any of the European varieties mentioned by Limpricht so far as can be determined from the material at hand. It is clear that Austin did not know the true *cirrosum* for there is a specimen of it from Colorado labelled in Austin's handwriting, "*Hypnum Coloradense var. dimidio minus, sericeo-aureo viride, caule subjulaceo tereti.*"

2. CIRRIPHYLLUM BRANDEGEI (Aust.).

Hypnum Brandegei Aust. Bot. Gaz. **3**: 31. 1878.

Gametophyte densely caespitose, yellow-green; stems erect, 3–4 cm. high, nearly simple, terete-foliate, obtuse; leaves loosely appressed-imbricate, not decurrent, ovate, abruptly subulate-acuminate to filiform-acuminate, 2 × 0.9 mm., acumination 0.3–0.4 mm. long, entire, concave, plicate; margins plane; costa reaching the middle of leaf, sometimes forking; median cells oblong-linear, 25–30 × 9 μ; basal cells shorter and broader, alar enlarged-quadrate. *Sporophyte* unknown.

Type locality, Colorado, Brandegee. Type in the Columbia University Herbarium.

Easily distinguished from *C. cirrosum* by its caespitose habit, short entire acumen and much looser areolation.

3. CIRRIPHYLLUM PILIFERUM (Schreb.).

Hypnum piliferum Schreb, Spicil. Flor. Lips. 91. 1771.

Eurhynchium piliferum Br. & Sch. Bryol. Eur. fasc. 57–61, *pl. 531.* 1854.

Rhynchostegium piliferum De Not. Cronaca, **2**: 11. 1867.

Brachythecium piliferum Kindb. Can. Rec. Sci. 1894: 73. 1894.

Gametophyte in wide loose mats, glossy, bright yellowish-green; stems long, sometimes reaching 20 cm., creeping, irregularly divided, pinnately branching, sparingly radiculose; branches rather distant, 10–15 mm. long, terete-foliate; branch leaves loosely erect, imbricate, decurrent, ovate, very concave and spoon-shaped, the rounded apex abruptly narrowed into a long, filiform acumination; 1.2 × 0.8 mm., smaller near ends of branches; acumination one-half length of the body of leaf, apex cucullate, margins strongly serrate, more nearly or quite entire at base, costa fully two-thirds length of body of leaf; median leaf-cells linear, 10–15 × 1; alar cells abruptly enlarged and inflated; stem leaves larger and more broadly ovate, 1.5–2 × 1 mm. (2–2.5 × 1–1.2 mm. according to Limpricht), enlarged and inflated alar cells more numerous: dioicous; male plants somewhat smaller; perigonial leaves ovate, long-acuminate, ecostate; perichaetium sheathing, the leaves ovate, somewhat abruptly narrowed to a very long slender erect-spreading acumination, somewhat serrulate, ecostate or some of the inner slightly costate. *Sporophyte* 2–3 cm. high; seta dark red-brown, twisted to the right, very rough with low blunt papillae; capsule red-brown, inclined to horizontal, oblong-ovoid, arcuate; urn 2.5 mm. long, 2–3 : 1; operculum nearly as long as the urn, long rostrate from a conic base; annulus of at least two rows of cells, detachable; teeth of peristome very slender pointed, very strongly papillose-roughened above; segments nearly or quite as long as the teeth, slender, split between the articulations; cilia 2 or 3, long and very slender, nodose to subappendiculate; spores smooth, 12–16 μ, maturing in winter or early spring; sporophyte rare.

Type locality, European.

On the ground and base of trees in woods and shady meadows, most frequently on steep springy shaded banks of rivulets, often closely interwoven with other mosses; New Brunswick, J. Moser New Hampshire, James; Vermont, Frost, Carey; New York, E. C. Howe, Peck; New Jersey, Austin; Pennsylvania, James, D. A. Burnett; Ohio, Sullivant; Washington, D. C., Oldberg.

ILLUSTRATIONS. Br. & Sch. l. c.; Hedw. Musc. Frond. **4**: 35, *pl. 14*, 1794: Husnot, Musc. Gall. *pl. 97;* Dixon & Jam. Handb. Brit. Mosses, *pl. 53, f. K.*

EXSICCATI. Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 290^b, (Ed. 2) 492. Austin, Musc. Appal. 336.

Infrequent or else overlooked because of its sterility.

Our American plant is much less robust than the European.

Cirriphyllum Tommasinii (Sendt.) (*Hypnum Vaucheri* Schimp. not Lesq.), has been several times reported from America but I have been unable to find any American specimens of this species in any of the herbaria enumerated above. *Brachythecium albicans* has been reported as this species and very likely forms of *C. cirrosum* may have been referred here.

4. CIRRIPHYLLUM BOSCII (Schwaegr).

Hypnum Boscii Schwaegr. Suppl. **1**: 223. 1816.

Hypnum illecebrum Hedw. Spec. Musc. 252. *pl. 66* (excl. varieties). 1806.

Eurhynchium Boscii Jaegr. & Sauerb. St. Gall. Nat. Gesell. 1876–77: 361. 1878.

Myurium Boscii Kindb. Can. Rec. Sci. 1894: 73. 1894.

Gametophyte in thick soft loosely intricate cushions, or in loose thin mats, on the ground among the grass, glossy, golden-yellow to brownish-yellow; stems creeping or ascending, irregularly divided and branching; branches and shorter stems suberect, turgid, terete-foliate; stems often stoloniferous and subpinnately branching, sparingly radiculose, 5–15 cm. long; branches 1–3 cm. long, the longer more or less subdivided; branch leaves erect-open when moist, loosely imbricate when dry, decurrent, scarious, broadly ovate, very concave, spoon-shaped, 2–2.5 × 1.4 mm., serrate to the middle, apex rounded and abruptly acuminate, acumination twisted one-half turn to the right; basal angles rounded, subauriculate; costa extending three-fourths length of leaf; leaf-cells thick-walled, the median linear, 6–10: 1, basal and apical shorter and broader, the alar not differentiated; leaves of the stoloniferous stems much smaller, less abruptly narrowed to the longer acumination, costa shorter: stem leaves less concave, less abruptly acuminate, acumination longer, less frequently twisted: apparently dioicous, male branches not seen; perichaetial leaves with oblong-ovate sheathing bases, abruptly narrowed to a filiform spreading acumination, ecostate and entire or toothed below base of acumination. *Sporo-*

phyte 1.5–3 mm. high ; seta red to red-brown, smooth, slightly twisted to the right ; capsule brown, inclined, unsymmetric to arcuate, gradually narrowed into the seta, oblong, strongly arcuate and contracted under the mouth when dry, with operculum 3–4 × 1 mm. ; annulus of at least two rows of cells ; operculum conic, long rostrate, about one-half the length of urn ; segments as long as the teeth, split between the articulations ; cilia 2 or 3, well developed, nodose ; spores nearly smooth, 16 μ ; maturing in autumn.

Type locality, North America ; collected by Bosc, probably in South Carolina. Type in the Boissier Herbarium at Geneva.

On the ground and rocks in shady places and open fields. Vermont to Florida and Louisiana, west to Missouri and Illinois ; more abundant southward. The only specimen I have seen from Canada was of Drummond's collection and was in Prof. Macoun's collection as from "Upper Canada." Prof. Macoun suggests that it may have been from Niagara Falls.

ILLUSTRATIONS. Sulliv. Icon. Musc. *pl. 106.*

EXSICCATI. Drum. Musc. Am. (S. States), 132 ; Sulliv. Musc. Allegh. 42 ; Sulliv. & Lesq. Musc., Bor. Am. (Ed. 2) 435, (Ed. 1) 294 ; Austin Musc. Appal. 331 ; Ren. & Card. Musc. Am. Sept. Exsic. 117.

A very striking and easily identified moss, but one which is unique in many respects and whose relationships are obscure.

Specimens of *Myuroclada concinna* (Wils.) Besch. communicated to Mrs. Britton by Bescherelle have been carefully compared with *Hypnum Boscii*, Schwaegr. Bescherelle, Ann. des Sci. Nat. VII. **17** : 380, 1893, intimates that the latter species belongs to his new genus *Myuroclada*, founded upon the former. The two species resemble each other superficially to a striking degree. The glossy golden yellow turgid branches, rostrate operculum, smooth seta, and very concave cochleariform leaves are marked characteristics of both, but under the microscope such important differences appear that I am not able to consider them congeneric. *M. concinna* has the segments of the inner peristome slender with cilia very rudimentary or none ; annulus lacking ; leaves obtuse : *leaf-cells thick-walled, broadly oblong*, to *oblong rhomboid, 1–2 : 1. Hypnum Boscii* has the segments broader : cilia 2 or 3, well developed ; leaves more or less long-acuminate, *leaf-cells linear, 8 10 : 1.*

The relationship of *Hypnum Boscii* to the other species referred to *Cirriphyllum* is somewhat less marked than the relationship between the other species of that genus, but it is closer than the relationship between *H. Boscii* and any other genus known to the author.

BRYHNIA Kaurin Bot. Not. 1892: 60. 1892.

(Named for the discoverer of the European representative of the genus, Dr. Nils Bryhn.)

Gametophyte medium sized, in intricate mats or cushions, bright yellowish green on the surface, dirty brownish green below. Stems creeping, irregularly divided and branching; central strand present. Leaves concave, serrate, decurrent, conspicuously papillose on the lower surface by the greatly thickened angles of the cell walls; median leaf-cells short, 4–6:1, rather thick-walled; basal and alar cells a little larger and more nearly rectangular. *Sporophyte* much as in *Brachythecium.* Seta rough, twisted to the right; capsule short-oblong, somewhat arcuate; operculum long-conic to subrostellate; annulus present, well developed; cilia one or two, well developed, nodose.

The two species which we have referred to this genus (previously known as *Eurhynchium Sullivantii* and *Brachythecium Novae-Angliae*) are undoubtedly very closely related and congeneric but the question of their further relationship is more difficult. They are seemingly intermediate between *Brachythecium* and *Eurhynchium* and were so regarded by the author of this genus. Limpricht admits the genus under protest and says that in his opinion the European representative belongs to *Brachythecium.* On the other hand, there has been an increasing tendency to refer the American representatives to *Eurhynchium.* The shortness of the leaf-cells is a character that does not pertain to *Brachythecium* (except in the anomalous *B. reflexum* and *B. cyrtophyllum*). The thickening of the angles of the cell walls to form papillae occurs in no species of *Brachythecium* and is much more strongly marked than in any other species referred to *Eurhynchium.* The sporophyte does not differ from that of *Brachythecium* except, perhaps, by the longer pointed operculum, but the operculum is far shorter than in *Eurhynchium.* On the whole, therefore, it seems more satisfactory to constitute a separate genus of these species.

M. Bescherelle (Ann. des. Sci. Nat. VII. **17**: 378. 1893) refers *B. Novae-Angliae* to *Scleropodium*, a disposition with which I cannot agree as the papillose leaves and the short leaf-cells are not characters of the genus as originally defined.

Branch leaves acute to short-acuminate, apex twisted.	1. *B. Novae-Angliae.*
Branch leaves longer acuminate, apex not twisted.	2. *B. graminicolor.*

1. BRYHNIA NOVAE-ANGLIAE (Sulliv. & Lesq.)

Hypnum Novae-Angliae Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 338. 1856. Sulliv. Mosses of the U. S. 76. 1856.

Brachythecium Novae-Angliae Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77: 338. 1878.

Hypnum scabridum Lindb. Bot. Not. 1887: 41. 1887.

Bryhnia scabrida Kaurin Bot. Not. 1892: 60. 1892.

Eurhynchium Novae-Angliae Kindb. Can. Rec. Sci. 1894: 23. 1894.

Hypnum (*Cratoneuron*) *chloropterum* C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 231. 1892.

Eurhynchium chloropterum C. Muell. & Kindb. Can. Rec. Sci. 1894: 23. 1894.

Gametophyte in wide loosely intricate mats, bright green on the outside, dirty brownish green below, stems decumbent; secondary stems sub-erect, about 5 cm. long, subpinnately branching; branches erect-ascending, terete-foliate, often subjulaceous, 5–10 mm. long; branch leaves erect-open, loosely appressed-imbricate when dry, ovate to ovate-lanceolate, decurrent, 0.8–1.2 × 0.4–0.6 mm., serrulate, very concave, not plicate, papillose on the under side by the thickened angles of the cell walls, long-acute to short-acuminate; apex twisted one-half turn to the right; costa thick, extending beyond the middle of the leaf; median leaf-cells oblong-hexagonal, 5 : 1; alar and basal cells little differentiated, somewhat enlarged; stem leaves broadly ovate to triangular-ovate, 1–1.4 × 0.8–1.2 mm., nearly smooth, longer acuminate; leaf-cells shorter, areolation of decurrent angles somewhat more loose and more nearly rectangular: dioicous; male branches gemmiform; antheridia oblong; perigonial leaves oblong-ovate, gradually long-acuminate; perichaetium about 2 mm. long; the leaves with sheathing bases and squarrose points; inner leaves oblong, long filiform-acuminate, somewhat serrulate above, costate. *Sporophyte* 1–2 cm. high; seta dark red-brown, very rough with broad low papillae; capsule dark red-brown, almost black when old, oblong cylindric, 3–3.5 mm. long, 4–5 : 1, somewhat arcuate, horizontal to suberect; operculum long-conic, subrostellate; annulus large; segments nearly as long as the teeth; cilia one or two, nearly as long as the segments, strongly nodose; spores minutely roughened, 17–19 μ, maturing in autumn or winter.

Type locality, mountains of New England.

On earth and stones in wet shady places, especially in mountain regions. Northeastern United States and eastern Canada; south to Maryland; west to Pennsylvania.

ILLUSTRATIONS. Sull. Icon. Musc. *pl. 118.* Limpr. Rab. Krypt. Pl. 4^3 : 139, *f. 377* (*Bryhnia scabrida*).

EXSICCATI. Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 338, (Ed. 2) 507; Aust. Musc. Appal. 329; Macoun, Can. Musc. 440; Ren. & Card. Musc. Am. Sept. Exsic. 109.

Easily distinguished by its rostellate capsule, short papillose leaf-cells and twisted leaf apices. The species varies considerably in length of the acumination of leaves so that var. *Delamarei* Ren. & Card. Fl. Miq. 50, does not seem worthy of special mention, although I have not seen specimens of that form.

Limpricht's description (*l. c.*) and several specimens of *Bryhnia scabrida* (Lindb.) Kaurin from Norway have been carefully compared with *B. Novae-Angliae* and the two are not to be distinguished. The measurements of the leaves given by Limpricht for *B. scabrida* are larger than those given for *B. Novae-Angliae* in my Rev. N. Am. Isotheciaceae and Brachythecia, but a further investigation has shown that the maximum measurements there given were too small. There is no difficulty in finding American plants with as large leaves as the European. Specimens of *B. Novae-Angliae* have been sent to Prof. Kaurin and were examined by him and submitted to his friend, E. Ryan. Both agree with me that the American and the European plant are the same. The Newfoundland plant referred by Kindberg to *B. scabrida* is certainly *B. Novae-Angliae.*

Mrs. Britton in 1889 first noted the great resemblance between *B. scabrida* and *B. Novae-Angliae* and sent specimens to Prof. Kaurin for comparison, but this was entirely overlooked in my revision of *Brachythecium.* In 1897 Dr. Best's attention was called to the matter by the Newfoundland plant named *B. scabrida* by

Kindberg, and Dr. Best very kindly called my attention to the great resemblance between the two plants.

Eurhynchium chloropterum seems to be nothing more than a slender lighter green form of *B. Novae-Angliae*, having the branch leaves more narrowly acuminate, more closely appressed and more contorted in drying. The areolation is not wider, and a specimen of Canadian Musci, no. 440 (on which the species appears to be founded), is most certainly dioicous. The perichaetial leaves are also faintly costate, as in the ordinary *B. Novae-Angliae*. It is found along the northeast coast of North America. Possibly it should be considered a variety. From my studies in this group I am led to believe that it is not a rare occurrence for male and female branches to occur on the same plant in a species that is ordinarily dioicous. *Vide* note on *Brachythecium Villardi*, Mem. Torr. Bot. Club, **6**: 180.

Mr. D. A. Burnett has communicated a peculiar form of this species from Bradford, Pa., growing on fine sand near the borders of a stream. The whole plant is much reduced and the leaves are more slenderly acuminate than usual.

2. BRYHNIA GRAMINICOLOR (Brid.).

Hypnum graminicolor Brid. Spec. Musc. **2**: 251. 1812.
Hypnum praelongum var. Sulliv. Musc. Allegh. 44. 1845.
Hypnum Sullivantii Spruce, A. Gray Man. Ed. 1. 1848.
Eurhynchium subscabridum Kindb. Ottawa Nat. **7**: 22. 1893.
Eurhynchium Sullivantii Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77: 354. 1878.

Gametophyte slender, in closely intricate mats or cushions, pale-green to yellow-green, dirty-brownish green below, stems 1–2.5 cm. long, creeping, irregularly divided and branching, sometimes stoloniferous, sparingly radiculose, often brown and denuded of leaves; branches ascending, 5–10 cm. long, terete-foliate; branch leaves loosely imbricate to open erect, ovate-lanceolate, 0.6–0.8 × 0.25–0.3 mm., decurrent, acuminate, sharply serrate nearly to base, concave with margins reflexed below, strongly papillose by the thickening of the angles of the cell walls; median leaf-cells small, linear-oblong, 4–6 : 1; quadrate alar cells few; stem leaves 0.75–1 × 0.4–0.45 mm., longer, and more slenderly acuminate: dioicous; perichaetial leaves sheathing with spreading points; the inner oblong-lanceolate, abruptly long filiform-acuminate, distantly serrulate, often with traces of a costa. *Sporophyte* 10–15 mm. high; seta red-brown, slightly twisted to the right, very rough with large crowded papillae; capsule red-brown, ovoid to subglobose, urn 1.5 mm. long and about two-thirds as broad; operculum short-rostrate, scarcely more than long conic when moist, one-half length of urn; annulus present, easily detachable; teeth very slender pointed; segments shorter than the teeth, little or not at all split; cilia two, well developed, nodose; spores nearly smooth, 13–15 μ, apparently maturing in autumn.

Type locality, Pennsylvania, Muhlenberg. Type at Geneva.

On the ground or rocks in moist and shady places. New Brunswick to Minnesota, Illinois, and Georgia; Missouri, Bush.

Local and rarely fruiting. Reported from Vancouver Island, Roell, Hedwigia, **35**: 69. 1896 but probably a mistake.

ILLUSTRATIONS. Sulliv. Icon. Musc. *pl. 105.*

EXSICCATI. Sulliv. l. c.; Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 291, (Ed. 2) 430; Aust. Musc. Appal. 334; Macoun, Can. Musc. 296.

Distinguished from *B. Novae-Angliae* by its more slender habit, smaller and more slenderly acuminate leaves which are much more strongly papillose.

2a. BRYHNIA GRAMINICOLOR HOLZINGERI (Ren. & Card.).

Eurhynchium Sullivantii Holzingeri Ren. & Card. Bot. Gaz. **19**: 239. 1894.

More densely caespitose; branches shorter, generally obtuse; leaves broader, shorter acuminate.

Type locality in the District of Columbia, Coville; New Jersey, Best; Missouri, Demetrio.

This is the extreme variation in the direction of the characters noted above. The other extreme is reached in Drummond's Musc. Am. (S. States) 133 and Ren. & Card. Musc. Am. Sept. Exsic. 196, which is more straggling and stoloniferous; branch leaves more distant and open, lanceolate, reaching 1 mm. in length by 0.25 to 0.3 in breadth, long subfiliform acuminate, very strongly dentate-serrate and very strongly papillose roughened; stem leaves ovate-lanceolate, longer acuminate, reaching 1.3 mm. in length.

This latter form I have not yet seen fruiting. It appears from the data at hand to grow on moist rocks. It is widely distributed, occurring in Ontario, Connecticut, New York, Pennsylvania and Missouri. If it should prove to be a good variety and not merely habitat form, I would suggest the name *B. graminicolor acuminata.*

Eurhynchium subscabridum Kindb. approaches this form, and, according to the opinion of M. Cardot and myself, is in no way distinguishable from forms of *B. graminicolor.*

M. Cardot has seen Bridel's type of *Hypnum graminicolor*, and has very kindly communicated notes and camera lucida drawings of the leaves. We are both agreed that it is identical with *Hypnum Sullivantii* Spruce.

EURHYNCHIUM Br. & Sch. Bry. Eur., fasc. 57–61. 1854.

Gametophyte well developed, never minute, green to yellow-green, growing in wide loose mats, or sometimes in dense tufts. Stems prostrate or creeping, more or less pinnately branched, sometimes closely and regularly pinnate, usually somewhat stoloniferous; central strand present in all the species. Branch leaves pluriseriate, not complanate or secund, acuminate to obtuse, serrate, concave, more or less plicate; costa single, extending to the middle or beyond, usually ending in a spine underneath; median cells linear, 8–12 : 1, basal broader and shorter, alar quadrate or round, apical cells strongly differentiated and rhomboidal to circular in the group of *E. strigosum.* Stem leaves ovate, acute to long and slenderly acuminate. Paraphyllia sparingly present in some species. *Sporophyte*, as in *Brachythecium*, except the operculum, which is very long rostrate, equaling ½–⅓ the length of the urn, except in the group of *E. myosuroides.*

The species of this genus are quite closely related to *Scleropodium* and *Brachythecium*, and it is difficult to give any general character, except the long rostrate operculum, which distinguishes this genus from *Brachythecium.* It is distinguished from *Scleropodium* by the broader, shorter leaf-cells.

The genus can be divided into three groups:

I. The group of *E. strigosum*, including *E. strigosum*, *E. robustum*, *E. fallax*, *E. diversifolium*, and *E. hians.* This group is easily distinguished by the differentiated apical cells.

II. The group of *E. praelongum*, including *E. praelongum*, *E. Oreganum*, and *E. Brittoniae.* This group is characterized by the broadly cordate-ovate, decurrent, abruptly long-acuminate stem leaves, and pinnate branching.

III. The group of *E. myosuroides*, including *E. myosuroides* and *E. stoloniferum*. This group is easily recognized by the shorter operculum and the small thick walled alar cells.

Apical cells of branch leaves oblong-rhomboidal to circular.*	
Seta rough.	1. *E. hians.*
Seta smooth.	
Leaves spreading.	
Branch leaves 0.6–0.9 mm. long.	2. *E. strigosum.*
Branch leaves 1–1.5 mm. long,† round-obtuse at apex.	3. *E. fallax.*
Leaves appressed-imbricate.	
Alpine or boreal; usually in dense mats or cushions; slender.	4. *E. diversifolium.*
Lowland; in looser mats; more robust.	2b. *E. strigosum praecox.*
Apical cells of branch leaves not differentiated.	
Alar cells merely broader and shorter than the median; operculum long rostrate.	
Seta smooth or nearly so; stem leaves nearly entire.	6. *E. Brittoniae.*
Seta rough; stem leaves serrate.	
Slender; variously branching, leaves not more than 1 mm. long.	5. *E. praelongum.*
Very robust; closely and regularly pinnate; branch leaves 1–1.5 mm. long.	7. *E. Oreganum.*
Alar cells minute, thick-walled; operculum conic or short rostrate.	
Branches seldom flagelliform; branch leaves 1–1.5 mm. long; plants of eastern North America.	8. *E. myosuroides.*
Branches often very long, flagelliform; branch leaves 1.5–2 mm. long; plants of the Pacific slope.	9. *E. stoloniferum.*

1. EURHYNCHIUM HIANS (Hedw.) Jaegr. & Sauerb, St. Gall. Nat. Gesell. 1876–77: 357. 1878.

Hypnum hians Hedw. Sp. Musc. 272, *pl. 70, f. 11–14.* 1801.

Hypnum praelongum Hedw. St. Cr. **4**: 76, *pl. 29.* 1797.

Pterigynandrum apiculatum Brid. Sp. Musc. **1**: 137. 1806.

Eurhynchium praelongum Br. & Sch. Bryol. Eur. fasc. 57–61. *pl. 8* (Excl. var.). 1854.

Hypnum distans Lind. Musc. Scand. 34. 1879.

Gametophyte in intricate, depressed mats, green to yellow-green, closely adherent to the substratum; stems 3–10 cm. long, creeping, strongly radiculose, little divided, extensively stolonifer-

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* *E. stoloniferum myurcellum* will be sought here.

† *E. strigosum robustum* has as large leaves, but they are acute.

ous, irregularly to subpinnately branching; branches ascending, nearly simple, 3–12 mm. long; branch leaves erect-spreading, appearing complanate when dry, 0.8–1.1 × 0.5–0.7 mm., ovate, not decurrent, obtusely acute to short-acuminate with apex often twisted to the right, sharply serrate to the base, concave to nearly plane, sometimes appearing papillose by the thickening of the angles of the cell-walls; costa stout, extending $\frac{4}{5}-\frac{5}{6}$ length of leaf, ending in a spine on the lower side of the leaf; median cells linear-oblong, 6–10 : 1; quadrate alar cells few, indistinct; apical cells rhombic, 2–3 : 1; leaves of stoloniferous stems small, 0.4–0.6 × 0.2–0.3 mm., ovate-lanceolate, rather abruptly narrowed into a slender acumination, costa thin and short; upper stem leaves much like branch leaves, short-acuminate: dioicous; perichaetial leaves oblong-ovate, sheathing, rather abruptly narrowed to a long squarrose-recurved acumination, nearly ecostate, distantly dentate-serrate above. *Sporophyte* 10–25 cm. high; seta dark red-brown, somewhat twisted to the right, very rough with low rounded papillae; capsule a little lighter colored, inclined to horizontal, oblong-cylindric, curved, urn 2–2.5 mm. long, 3 : 1; little or not at all contracted under mouth when dry; operculum long-rostrate, three-fourths length of urn; annulus present, narrow, easily detached; segments nearly as long as teeth, more or less split; cilia usually 2, sometimes 3, strongly nodose; spores nearly smooth, 10–12 *μ*, maturing in late autumn.

On the ground in moist, shady places. Canada to the Gulf of Mexico east of the Mississippi; Minnesota, Holzinger; Missouri, Bush.

Type locality, Pennsylvania.

EXSICCATI. Drumm, Musc. Am. (S. States) 134. Sulliv. Musc. Allegh. 53; Sulliv. & Lesq. Musc. Bor. Am. (Ed. 1) 290, (Ed. 2) 428; Aust. Musc. Appl. 335; Ren. & Card. Musc. Am. Sept Exsic. 118 (E. *praelongum*).

ILLUSTRATIONS. Sulliv. Icon. Musc. *pl. 104;* as *E. praelongum*, Hedw. l. c.; Br. & Sch. l. c.; as *E. Swartzii* Dixon & Jam. Handb. Brit. Mosses, *pl. 54* B.

A form from Florida (Austin, Underwood) has ovate-lanceolate branch leaves which are much more sharply acute than is usual.

A comparison of the difference between *E. praelongum* Hedw. and *E. hians* as given by Limpricht.

E. praelongum.	*E. hians.*
Not shining, golden green.	Golden green and opalescent, shining.

In the 50 or more specimens of each species that I have examined I have been unable to see that there is any difference in this respect.

All leaves distant.	Stem leaves distant, branch leaves close.

There is a great variation in this respect in the plants referred to both species but I can detect no perceptible difference between the European *E. praelongum* (Hedw.) and the American *E. hians*.

Cells of stem leaves 5–8 : 1.	Cells of stem leaves 7–12 : 1.

There is also a great variation in this respect in both, but no constant difference, and this variation does not seem to be correlated with the variations in the shape of the leaves.

Branch leaves almost plane.	Branch leaves very concave.

There is absolutely nothing in this distinction. The leaves of either may be plane or concave and there are great differences in this respect even on the same plant.

Perichaetial leaves faintly costate.	Perichaetial leaves ecostate.

Sullivant (Icones Muscorum, 163) says of *E. hians*; "Perichaetial leaves subcostate." There are faint but distinct traces of a costa in some or all of the perichaetial leaves in most of the *E. hians* I have examined. Mr. Dixon writes me that the perichaetial leaves of the British plant referred to *E. praelongum* Hedw. are often ecostate.

Seta purple.	Seta red.

This also does not hold.

Annulus persistent.	Annulus easily detachable.

I have not tried to verify this because it involved so much mutilation of specimens. It is a very doubtful distinction to say the least.

Seta 15–25 mm. long.	Seta 10–13 mm. long.

The seta of the European plant does seem to average a little longer, but there are plenty of specimens of American *E. hians* with seta 15–25 mm. long. So far as can be determined the length of the seta is not correlated with any of the other characters given as distinguishing.

Capsule strongly contracted under the mouth when dry.	Capsule not at all contracted under the mouth when dry.

I could distinguish absolutely no difference in this respect.

Spores faintly roughened.	Spores smooth.

There is no perceptible difference in this respect.

Acumination of stem leaf one-tenth length of leaf.	Acumination of stem leaf one-sixth length of leaf.

There is a very great range of variation in this respect even on the same plant, but I was unable to discover any constant difference between the two.

All leaves similar in form.	Lower leaves lanceolate to ovate, 0.2–0.3 mm. wide, suddenly narrowed to a narrow reflexed acumination one-third the length of leaf.

Leaves of stoloniferous stem of both are much reduced in size and in very many cases long-acuminate in the European plant referred to *E. praelongum.*

To sum up: There is a very great range of variation in the characters enumerated above, especially in the width of the branch leaves and the length and slenderness of their acumination. The apex of the branch leaves of the European plant is slenderly acuminate in a larger proportion of cases than in the American, and the seta of the European plant averages longer.

E. hians is generally credited to Europe but the distinctions given will not hold as we have seen. If two species are to be made out of the European plants referred to *E. hians* and *E. praelongum* Hedw., the distinction will have to be based on different characters, one of which will, it seems to me, be the shape of the branch leaves. Our American plant differs considerably in this respect. Specimens from the Southern States have, as a rule, more slenderly pointed branch leaves, but there are all grades of intermediate forms and the difference is too slight to be of specific rank.

All the variations of the American plant can be duplicated in the European plant referred to *E. praelongum*, but the European plant varies further in the direction of narrow slenderly acuminate branch leaves with fewer differentiated apical cells.

Lindberg (*l. c.*) when separating *Hypnum distans* from *H. hians* evidently took his idea of *H. hians* from Sullivant's figure, which does not accurately represent the American plant as I understand it after having examined hundreds of specimens. In Sullivant's figure the leaves are much more slenderly acuminate and the apical cells much narrower in proportion to their length than in almost all the plants I have seen. The figures of the branch leaves of *E. praelongum* (Hedw.) in the Bryologia Europea represent the branch leaves of *E. hians* much better than Sullivant's figure. The other European authors who have treated this species since Lindberg wrote seem to have adopted substantially his idea of *E. hians*.

Mr. H. N. Dixon has exchanged a large number of specimens with me and has carefully gone over the evidence of the identity of the European and American plant. He believes that *Hypnum atrovirens* Swartz, Disp. 65. 1799, is also identical with *E. hians*.

2. EURHYNCHIUM STRIGOSUM (Hoffm.) Br. & Sch. Bryol. Eur. fasc. 57–61, *pl. 519*. 1854.

Hypnum strigosum Hoffm., D. Fl. **2**: 76. 1796.

Hypnum thuringicum Brid. Musc. Recent. **2**^{2}: 99. *pl. 3. f. 2.* 1801.

Hypnum pulchellum Hedw. Sp. Musc. 268. *pl. 68 f. 1–4.* 1801.

Hypnum velutinoides Voit. Musc. Herbip. 99. 1812.

Rhynchostegium strigosum De Not. Cronaca, **2**: 11. 1867.

Gametophyte in wide loose mats, with a habit much like *Brachythecium velutinum*, green to yellow-green, stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately to subfasciculately branching; branches 3–8 mm. long, ascending or erect, terete-foliate, often appearing somewhat complanate foliate when dry, attenuate at the ends; branch leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly, or not at all decurrent, 0.7–1 × 0.3–.55 mm., acute or often obtuse, especially towards the ends of the branches, sharply serrate above, concave, little or not at all plicate; costa extending four-fifths length of leaf, ending in a spine underneath, median leaf-cells linear, 7–10 : 1; quadrate and oval alar cells few, apical cells conspicuously shorter and broader, oblong-rhomboidal, 2–3 : 1; stem leaves elongated-triangular-ovate, more or less long-acuminate, gradually slender pointed, somewhat decurrent, serrate, 0.9–1.2 × 0.4–0.6 mm.; apex often twisted half around to the right; leaves of the stoloniferous stems, triangular-ovate, abruptly long-acuminate, ecostate, 0.7–5 × 0.3 mm.: dioicous or pseudo-monoicous, "annual buds containing antheridia adhering to radicle of fertile plants;" perichaetial leaves with sheathing bases and spreading points, oblong, narrowed to a slender subfiliform spreading acumination, ecostate, distantly serrate.

Sporophyte 10–20 mm. high; seta red-brown, smooth, twisted to the right; capsule brown to red-brown, oblong-ovoid to oblong-cylindric, unsymmetric, inclined to horizontal; urn 2–2.5 : 1, constricted below mouth when dry; operculum ½–⅔ length of urn, abruptly long-rostrate; annulus of 2 or three rows of cells; segments nearly as long as teeth, split; cilia 2 or 3, nodose; spores 10–12 μ, nearly smooth, maturing in autumn.

Type locality, European.

On the ground, roots of trees, and decaying logs in woods and shady places; seemingly preferring steep shaded banks of ravines.

Ranging from Washington, British Columbia and Alaska to Labrador, south to the White Mountains, the Adirondacks, and the mountains of Colorado.

ILLUSTRATIONS. Br. Sch. l. c; Hedw. l. c.; Wils. Bryol. Brit. *pl. 55;* Husnot, Musc. Gall. *pl. 96;* Dixon & Jam. Handb. Brit. Mosses, *pl. 54. K.*

The leaves of this species and its relatives vary so in shape that any attempt to define species by the degree of acuteness of the leaves or other similar character seems futile.

2a. EURHYNCHIUM STRIGOSUM ROBUSTUM Röell, Hedwigia, **36**: 52. 1897.

Eurhynchium strigosum (in part) of American authors.

Gametophyte with the habit of *Brachythecium plumosum*, in wide intricate mats, green to yellow-green; stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately or subfasciculately branching; branches 6–12 mm. long, ascending or erect, often fasciculately divided, terete-foliate, more blunt than in *E. strigosum*; leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly or not at all decurrent, 1–1.3 × 0.4–0.5 mm., usually acute; quadrate and oval alar cells confined to the extreme angles; stem leaves 1.2–1.5 × 0.4–0.6 mm., longer acuminate, acumination often subfiliform. *Sporophyte* rather larger than in the typical form.

Type locality, vicinity of Chicago, Illinois. Type duplicate in the herbarium of Columbia University.

Eastern Canada and in the United States from Louisiana to Minnesota and eastward. More abundant northward.

EXSICCATI. (As *Hypnum strigosum.*) Drumm. Musc. Am. (S. States) 131; Sulliv. Musc. Allegh. 11; Sulliv. & Lesq. Musc.

Bor.-Am. (Ed. 1) 292, in part, (Ed. 2) 431, in part; Aust. Musc. Appal. 332; Macoun, Can. Musc. 295.

The great majority of plants from eastern North America that have been referred to *E. strigosum* belong to this variety. Forms agreeing very closely with European *E. strigosum* are not rare in the United States and Canada, and are seemingly more frequent in elevated regions. Intergrading forms are very numerous, diversified, and extremely puzzling.

2b. EURHYNCHIUM STRIGOSUM PRAECOX (Hedw.) Husnot, Musc. Gall. 332. 1893.

Hypnum praecox Hedw. Spec. Musc. 249, *pl. 64.* 1801.

Gametophyte caespitose or in looser intricate mats, green to yellow-green; stems creeping, 2–3 or even 8 cm. long, irregularly divided, subfasciculately branching, often stoloniferous; branches 3–6 mm. long, erect, julaceous, usually blunt; branch leaves crowded, imbricate-appressed when dry, erect-open when moist, cordate-ovate, more or less decurrent, 0.5–0.8 × 0.4–0.6 mm., almost acute to very obtuse and rounded at apex, serrate above, serrulate nearly to the base, more or less plicate, concave with borders often reflexed below; costa extending at least three-fourths the length of the leaf, ending in a spine underneath; median cells linear-oblong, 6–8 : 1; quadrate and oval alar cells numerous, apical cells rhomboidal to nearly circular; leaves of the stolons much as in *E. strigosum;* stem leaves acute to abruptly filiform-acuminate, triangular-ovate, decurrent, 0.8–1 × 0.6 mm., serrulate, costate to the middle. *Sporophyte* 6–10 mm. high; capsule ovoid, unsymmetric, horizontal; urn 1.5–2 : 1, more or less contracted under the mouth when dry and empty; operculum two-thirds length of urn, convex, abruptly long-rostrate; cilia 1–3, strongly nodose; spores very finely roughened, about 12 μ, maturing in autumn.

"More depauperate than the species, tufts loose, deep green; stems shortened, thick and nearly naked; branches and branchlets erect, 3–5 mm. long; stem leaves 0.7 mm. long by 0.4 mm. broad, plicate; branch leaves close, appressed-imbricate, broadly ovate, short acuminate, 0.6 mm. long by 0.3 mm. broad, margins somewhat reflexed above the middle, plicate; the upper branch leaves sometimes obtuse; leaf-cells 6 μ long, 10 : 1, elongated in the acumination; costa extending three-fourths the length of the leaf, ending in a spine on the under side. Sporophyte like the species; seldom fruiting." *Limpricht, Rab. Krypt. Fl.* 4^3: 159. 1897.

On shady banks, moist soil and rocks. New York, New Jersey, Pennsylvania; Texas, G. Jeremy.

Type locality, Sweden.

ILLUSTRATIONS. Br. & Sch. Br. Eu. *pl. 519, f. β.*

EXSICCATI. Drumm. Musc. Am. (S. States) 130 (*Leskea fasciculosa*); Sulliv. & Lesq. Musc. Bor.-Am. (Ed. 1) 293, (Ed. 2) 432; Aust. Musc. Appal. 333.

Distinguished from the species by the julaceous branches, appressed-imbricate leaves, more obtuse and more decurrent.

2c. EURHYNCHIUM STRIGOSUM SCABRISETUM var. nov.

Seta plainly scabrous with scattered papillae; otherwise like var. *praecox.*

On shaded ground.

Type in the Columbia Herbarium from the Palisades, N. J., Austin; Sargentsville, N. J., Best; Rensselaer Co., N. Y., E. C. Howe; Vineyard Haven, Mass., R. E. Schwab.

In most sets of both editions of Sulliv. & Lesq. Musc. Bor.-Am. a portion of the specimen labeled *E. strigosum* is smaller and has julaceous branches and in some sets of Ed. 1, a scabrous seta. This portion I should refer to var. *praecox* or var. *scabrisetum* as the case may be.

The roughening of the seta is a character not mentioned in any European work or observed in any European specimen, and is probably a new development.

As a rule the branch leaves of *E. fallax* are strongly decurrent, those of *E. strigosum praecox* and *E. diversifolium* somewhat so, while those of *E. strigosum* are usually not at all decurrent. The stem leaves of all these forms are more or less decurrent.

All the available literature on *E. strigosum, E. strigosum praecox* and *E. diversifolium* has been carefully studied to discover a satisfactory arrangement of the forms usually referred to these species. The result has been very unsatisfactory and the matter cannot be definitely settled until the types are compared with American material. The European material in the Herbarium of Columbia University indicates that the forms usually referred to *E. diversifolium* belong rather to *E. strigosum praecox* and accordingly this ground is taken provisionally. Limpricht's description of the variety *praecox* is copied and a full description of the American plant is given. Some discrepancies will be noted. Some of the American forms referred provisionally to var. *praecox* are more robust than any European material which has been examined. Limpricht says that the true *E. diversifolium* is a true alpine moss, "Ein echtes Hochalpenmoos," which the *E. diversifolium* of Lesq. & James and most other American authors is not.

In the mountainous and boreal regions of the northern United States and Canada west of the longitude of the Mississippi there is found an alpine moss which agrees very closely with Rabenhorst's Bryoth. Eur. No. 1143 (*E. diversifolium*), which is cited by Limpricht (*l. c.* 160). This western plant has been referred to *E. diversifolium.* This view is seemingly contradicted by the fact that Schimper in the Bry. Eur. under *E. diversifolium* refers to it specimens from Ohio.

Whatever may be true of the names, the forms described, though intergrading to a considerable extent, are still so well defined as to be readily recognized.

3. EURHYNCHIUM FALLAX (Ren. & Card.).

Eurhynchium strigosum var. *fallax* Ren. & Card. Bot. Gaz. **14**: 98. 1889.

Eurhynchium substrigosum Kindb. Macoun, Cat. Can. Pl. 6: 205. 1892.

Gametophyte in loosely intricate mats; robust, green to light yellow-green; stems 5–10 cm. long, procumbent, arcuate, ascending, often stoloniferous and rooting at the ends, giving off several secondary stems that bear comparatively few branches, branching irregular to subpinnate; branches 7–15 mm. long, terete-foliate, attenuate; branch leaves erect-open, usually long-decurrent, cordate-ovate to lanceolate-lingulate, 0.8–1.2 × 0.4–0.55 mm., rounded-obtuse, serrate above, serrulate to the base, concave, usually slightly plicate when dry; costa extending about seven-eighths the length of the leaf, ending in a spine underneath; median leaf-cells linear, 9–12 : 1; quadrate alar cells numerous; apical cells of various shapes, oblong-elliptical, elliptical, and circular; stem leaves larger and more narrowed at apex, 1.2–1.5 × 0.5–0.8 mm., only the lower and those of the stoloniferous stems acute or long-acuminate: monoicous; male branches scarce: perichaetial leaves with oblong sheathing bases, very abruptly narrowed to filiform erect-spreading acumination, the inner with a long thin costa, serrulate or entire. *Sporophyte* 15–20 mm. high; seta red-brown, smooth, twisted to the right; capsule brown, oblong, unsymmetric, horizontal; urn 2.5 × 1 mm., little constricted below the mouth when dry and empty; operculum conic, abruptly long-rostrate, beak two-thirds length of urn; annulus present, of at least two rows of cells; cilia stout, 2 or 3, nodose to subappendiculate; spores minutely roughened, 10–13 μ, maturing in winter.

Type locality, on old logs, Lake Pend d'Oreille, Idaho, Leiberg.

On the ground, roots of trees and decaying logs. Northern United States and Canada, in the Rocky Mountain region. Alaska, O. S. Bates; British Columbia, Macoun; Idaho, Sandberg, and Leiberg; Montana, Watson; Colorado, Wolf and Rothrock.

EXSICCATI. Ren. & Card. Musc. Am. Sept. Exsic. 116. Macoun, Can. Musc. 449, in the Columbia Herbarium as *E. substrigosum* Kindb., is not the species, but appears to be *E. strigosum robustum.* Authentic material of *E. substrigosum* has been examined.

Distinguished from *E. strigosum robustum* by the more diffuse straggling habit, more distant leaves, branch leaves broad and rounded at apex, and less acute stem leaves; from *E. strigosum* and its other varieties, and the other closely allied species it is easily distinguished by its greater size and looser habit.

3a. EURHYNCHIUM FALLAX BARNESII (Ren. & Card.).

Eurhynchium strigosum var. *Barnesii* Ren. & Card. Bot. Gaz. **14**: 98. 1889.

Stouter, with more slender, lingulate leaves which are also narrower at apex; capsule much larger and thicker.

Type locality the same as for the species.

Collected several times in Idaho by Sandberg and by Leiberg.

4. EURHYNCHIUM DIVERSIFOLIUM (Schleich.) Br. & Sch. Bry. Eur. fasc. 57–61, *pl. 520.* 1854.

Hypnum diversifolium Schleich. in Herb. and Catal. 1807. (In part.) *Teste* Limpricht.

Eurhynchium strigosum var. *diversifolium* Molendo & Lorentz, Flora. 1867.

Gametophyte caespitose or in thick, densely intricate mats, green to yellow-green; stems 2–7 cm. long with long thick stolons, creeping, densely radiculose, sending up numerous fasciculately divided branches; branches short, 2–5 mm. long, julaceous, blunt; branch leaves appressed-imbricate, ovate, acute or rounded-obtuse, 0.5–0.6 x 0.36–0.45 mm., serrulate, concave, excavate at the slightly decurrent angles; costa extending four-fifths length of leaf, often ending in a spine underneath; median leaf-cells linear to linear-oblong, 5–8 : 1, apical rhomboidal or nearly circular; area of quadrate alar cells much larger than in any of the allied species; stem leaves ovate, acute to long-acuminate, decurrent, 0.8–1 x 0.6–0.75 mm.; leaf-cells narrower and longer, apical cells not differentiated; costa seldom ending in a spine; leaves of stoloniferous stems varying greatly in size on the different parts of the stolon: slightly open, without chlorophyll, elongated-triangular, long and narrowly acuminate; excavate at the angles, very long and narrowly decurrent; costa slender or wanting, "dioicous or pseudo-monoicous;" perichaetial leaves sheathing at base, with spreading acumination, oblong-ovate, abruptly long-acuminate; costa thin or wanting. *Sporophyte* 5–10 cm. high; seta red-brown, smooth, twisted to the right; capsule red-brown, ovoid to short-oblong, unsymmetric and inclined; 1.5 : 1, slightly contracted under the mouth when dry; operculum long-rostrate, nearly as long as the urn; "annulus of two rows of cells, persistent;" segments from a basal membrane one-third the length of the teeth; cilia 2 or 3, appendiculate; spores finely roughened, 14–18 μ, maturing in winter.

Type locality, European. Type at Kew.

On the ground and rocks in mountainous and boreal regions of western North America, especially in the Rocky Mountain region: Utah, Watson; British Columbia, Macoun; Idaho, Leiberg; Montana, R. S. Williams; Colorado, Mrs. S. L. Clark, and Marie Holzinger; Ohio, *fide* Schimper, l. c.; S. Dakota, M. A. Thompson.

ILLUSTRATIONS. Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 96, f. 8–9*; Limpricht, Rab. Krypt. Fl. 4^3, *f. 34*.

EXSICCATI. Macoun, Can. Musc. 500.

Limpricht, *l. c.*, describes the branch leaves as round-obtuse with the costa seldom reaching three-fourths of the length of the leaf, but Rabenhorst's Bryotheca Europea, 1143, which he cites agrees with the American material in these respects as well as in the dimensions of the leaf-cells. It seems pretty certain that our American plant here referred to *E. diversifolium* agrees with Limpricht's idea of this species and it certainly agrees with the accessible European exsiccati. While resembling *E. strigosum praecox* in many ways it can be readily distinguished by its slender habit, smaller branch leaves and more numerous quadrate alar cells.

5. EURHYNCHIUM PRAELONGUM (Dill. L.) Bryhn, Explor. Bryol. in Valle Norv. Stördalen, 59. 1893. (*Fide* Limpricht.)

Hypnum repens filicium, triangularibus parvis foliis praelongum Dill. Cat. Giss. 219. 1718, et Hist. Musc. 278. *pl. 35, f. 15a.* 1741, et herbarium (*Teste* Lindberg).

Hypnum praelongum L. Sp. Pl. 1125. 1753. (Non Hedw. St. Cr. **4**: 76. *f. 29.* 1797.)

Eurhynchium pseudospeciosum Kindb. Can. Rec. Sci. 1894: 22. 1894.

Eurhynchium acutifolium Kindb. Rev. Bryol. **22**: 84. 1895.

"Stems (in the type) slender, prostrate, elongated (2–5 inches), divided; at intervals rather regularly pinnate, with slender, somewhat attenuated, often curved, not very crowded, subcomplanate branches; forming low, somewhat straggling masses of a bright or dull green, less commonly yellowish. Stem leaves distant or more rarely crowded, widely cordate-triangular or widely ovate-cordate, rapidly or even abruptly and longly acuminate in a long often almost filiform, squarrose acumen; at base wide, excavate, strongly decurrent; margin plane, regularly and distinctly denticulate, nerve slender, reaching above half-way and usually into the acumen; cells linear, slightly vermicular, tapering but obtuse, 10–18 times as long as wide, pellucid; towards base wider and shorter, lax, at angles large, subrectangular, but not forming clearly defined auricles. Paraphyllia occasionally but not always present. Branch leaves much narrower, widely or even narrowly lanceolate, gradually acuminate, very acute, somewhat erect when dry, more spreading when moist, not complanate, moderately soft in texture and often twisted when dry, not plicate, hardly glossy. Perichaetial bracts squarrose, very longly acuminate. Seta rather long, often one inch. Capsule turgidly ovate, narrower when ripe and empty, horizontal, abruptly passing into the seta at base, rather large; lid subulate-rostrate, usually decurved, almost as long as the capsule. Dioicous."

The above excellent description is copied from Dixon and

Jameson's Handbook of British Mosses, p. 416. The species is rare in America and Mr. Dixon has had a much better chance to become acquainted with it, as it is common in England.

Type locality European.

On soil and decayed stumps.

California: Bolander, no. 83;[*] Olema, Marin Co., Jan. 11, 1894 (on old logs) Howe; San Mateo Mts., S. H. Burnham; White Mts., N. H., Oakes; Oregon, Hall; Vancouver Island, Lyall, Macoun; Washington, Suksdorf, Piper, Fenzler.

ILLUSTRATIONS. Dill. *l. c.;* Dixon & Jam. Handb. Brit. Mosses, *pl. 54 A.*

EXSICCATI.[*] Sulliv. & Lesq. Musc. Bor. Am. (Ed. 2) 433, (*Hypnum Stokesii*). Also sent out by Macoun as No. 100 of his Canadian Cryptograms under the name of *Eurhynchium pseudospeciosum.* Canadian Musci 442 (*E. hians*?).

There has been an almost endless amount of confusion as to the nomenclature of this plant. Wilson, Mitten, Dixon and Lindberg have applied the name to one plant, and Hedwig, Schimper, Husnot, Limpricht, and Cardot to another. The plant of Lindberg and the British bryologists is very closely allied to *E. Stokesii*, indeed, the latter appears to be only a variety of it. The *E. praelongum* of Hedwig and Schimper is identical with our *E. hians.* Now the two species that have borne this name are utterly and entirely distinct and could not be confused by the veriest tyro. The decision as to what is the true *E. praelongum* must rest with the Dillenian plant on which Linnaeus founded *Hypnum praelongum.* Lindberg saw the plant in Dillenius' herbarium[†] and declares that it is the plant that the British bryologists have called *E. praelongum.* As Lindberg was an acute observer, and has the best possible grounds for his opinion, I shall follow him until something more authoritative appears. One reason for the continuance of the confusion is the fact that the true *E. praelongum* is rare on the continent and in America and when found has nearly always been referred to *E. Stokesii.*

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[*] Mr. Dixon has examined the starred plants.

[†] Lindberg's statement is found in his Kritik Granskning af Mossorn uti Dillenia Historia Muscorum, 17, 1883. He gives the following citation from Dillenius' Hist. Musc. and herbarium: "15. H. repens filicinum triangularibus parvis foliis praelongum. P. 278, tab. 35. fig. 15. Herb. fol. 93. no. 15." He then adds this note: "Fig. A. Hypnum praelongum L. c. fr. —vera planta, cujus subspecies H. stokesii Turn. est nec auctorum recentiorum (h. e. H. distans Lindb.)."

E. praelongum is distinguished from its variety *Stokesii* by its less robust, more straggling appearance, less rigid stems, fewer paraphyllia and less regularly pinnate and less bipinnate branching. There is not the difference between the relative dimensions of the leaf-cells that is indicated by the two descriptions. I think Mr. Dixon's figures are too large. The leaves of the species are frequently more distant than those of the variety and the branches are much fewer in number.

Dr. Roell has sent to Mrs. Britton specimens of Fenzler's collection of *Eurhynchium acutifolium* Kindb. from the type locality at Enumclaw, Washington. This plant is not different from *E. praelongum.* It is described as "monoecious" but one fragment 3 cm. long bore five male branches and no female thus giving evidence of being dioicous. Fenzler's plant is a brighter yellow than the majority of specimens of *E. praelongum.*

5a. EURHYNCHIUM PRAELONGUM STOKESII (Turn.) Dixon l. c.

Hypnum Stokesii Turn. Musc. Hiber. 159. *pl. 15. f. 5.* 1804.

Hypnum praelongum var. *Stokesii* Brid. Sp. Musc. **2**: 103. 1812.

Eurhynchium Stokesii Br. & Sch. Bryol. Eur. fasc. 57–61. *pl. 526.* 1854.

Gametophyte in wide intricate mats, green to light yellowish green; stems rigid, procumbent, often stoloniferous, irregularly divided; 10–13 cm. long, sparingly radiculose, sending up suberect secondary stems which are closely and regularly pinnate, often bipinnate and 2–3 cm. long, branching more or less perfectly pinnate; branchlets slender, 3–13 mm. long, terete-foliate; branch leaves erect-open, decurrent, ovate-lanceolate, acuminate, 0.7–0.8 × 0.45 mm., smaller at the apex of the branches and on the smaller branchlets, serrate above, serrulate to the base; angles of the cell walls very slightly papillose-thickened; costa extending three-fourths length of leaf, often ending in a spine underneath; median cells oblong-linear, 5–8 : 1, broader and shorter at the decurrent angles; stem leaves distant, squarrose, strongly decurrent, triangular-ovate, abruptly long and slenderly acuminate, 0.7–0.9 × 0.9–1.3 mm., serrate (nearly entire on some of the stoloniferous portions) basal cells thicker walled, quadrate alar cells more numerous than in the branch leaves; paraphyllia borne sparingly on the stems (Dixon *l.*

c. describes the paraphyllia as numerous), leaf-like, triangular-ovate to ovate-lanceolate: dioicous; perichaetial leaves ovate with sheathing bases, abruptly narrowed to a long slender squarrose acumination, strongly dentate-serrate, ecostate. *Sporophyte* 2–3 cm. high; seta red-brown, stout, twisted to the right, very rough with large blunt papillae; capsule oblong-ovoid, red-brown, slightly unsymmetric, horizontal, slightly contracted under the mouth when dry; urn about 2 mm. long, 1.5–2 : 1; operculum long-rostrate, nearly as long as urn; annulus large, easily detachable; segments nearly as long as the teeth; cilia 2 or 3, nodose; spores 10–14 μ, maturing in late autumn or early winter.

Type locality, Ireland.

On the ground and roots of trees, west of the Rocky Mountains in the northern United States and Canada, Idaho, Washington, Oregon, California, Vancouver Island, British Columbia. Apparently common within this range. Newfoundland (*Fide* Cardot).

ILLUSTRATIONS. Turner, l. c.; Br. & Sch. l. c.; Husnot, Musc. Gall. *pl. 98.*

EXSICCATI. Macoun, Can. Musc. 297; Ren. & Card. Musc. Am. Sept. Exsic. 119.

Our American plant is as a rule considerably stouter than the European and more regularly pinnate varying towards *E. Oreganum* which is most certainly a derivative of it. One of the best characterized of these forms is

5b. EURHYNCHIUM PRAELONGUM CALIFORNICUM var. nov.

Gametophyte with the habit of a *Thuidium*; stems 15–20 cm. long, closely and regularly pinnate, seldom stoloniferous, more robust throughout; leaves of the maximum size.

Type from California, Bolander no. 46. 1876. In the herbarium of Columbia University.

6. EURHYNCHIUM BRITTONIAE sp. nov.

Gametophyte in wide intricate mats, dark green; stems creeping, radiculose, 5–10 cm. long, sparingly divided; branching closely and regularly pinnate; branches 5–10 mm. long, terete-foliate; branch leaves open-erect, 0.7–0.9 × 0.3–0.4 mm., gradually long-acuminate, lanceolate to ovate-lanceolate, serrate to the base, slightly or not at all decurrent; leaf-cells oblong-linear, 5 : 1, alar quadrate; costa extending four-fifths the length of the leaf, often ending in a spine underneath ; stem leaves deltoid-ovate, 1.8 × 1 mm., including the filiform acumination which is 0.5–0.8 mm. long, serrulate at base, nearly entire above, strongly excavate at the decurrent angles ; quadrate and rhomboidal alar cells numerous ; perichætial leaves sheathing at base, ovate to oblong-ovate, with a long filiform squarrose acumination, ecostate, distantly spinose toothed on the margins above. *Sporophyte* 1.5–2 cm. high ; seta red-brown, twisted to the right, nearly or quite smooth ; capsule oblong-cylindric, unsymmetric and horizontal ; urn 1.5 mm. long, 2 : 1, contracted below the mouth when dry ; operculum long-rostrate, at least two-thirds the length of the urn ; annulus ? segments from a basal membrane which is at least two-thirds the height of the teeth ; segments split between the articulations ; cilia 2 or 3, strongly nodose ; spores finely roughened, about 15 μ.

Type from California, Bolander. Specimens of this species of Bolander's California collections are in the National Museum from "Little River (Mendocino Co.?) at the foot of pine tree, no. 332." Also in the herbarium of Mr. J. M. Holzinger as no. 530.

This species is very closely related to *E. praelongum Californicum* and greatly resembles it in appearance but is easily distinguished by its nearly smooth seta and nearly entire stem leaves.

Named in honor of Mrs. E. G. Britton in recognition of her assistance in the preparation of this monograph and of her services to American bryology.

7. EURHYNCHIUM OREGANUM (Sulliv.) Jaeger & Sauer. St. Gall. Nat. Gesell. 1876–77 : 361. 1878.

Hypnum Oreganum Sulliv. Mem. Am. Acad. 4 : 172. 1849.

Gametophyte in wide loose mats ; yellow-green above, brownish green below the surface ; stems procumbent, densely radiculose at points of contact with substratum, 6–25 cm. long ; sparingly divided, closely and regularly pinnate, often bipinnate ; branches 1.3–2.5 cm. long ; branches terete-foliate, tapering ; branch leaves open, erect, decurrent, broadly cordate-ovate, 1–1.5 × .75–1 mm., acuminate, sharply serrate above, serrulate to base, somewhat concave and slightly plicate, costa stout, extending nearly to base of acumination, ending in a spine at the back ; median cells linear, about 7.1 ; extreme alar cells thick-walled, oblong to rhomboidal ; stem leaves larger, reaching 2 × 1.3 mm., more broadly ovate, longer acuminate : dioicous ; male branches abundant ; perigonial leaves ovate, long-acuminate, ecostate, distinctly dentate ; antheridia numerous, clavate ; perichaetial leaves sheathing at base with reflexed points, ovate to oblong-ovate, abruptly long and slenderly acuminate, ecostate, sharply dentate-serrate. *Sporophyte* 2–2.5 cm. high; seta red-brown, twisted to the right, very rough with high blunt papillae; capsule lighter colored, horizontal to slightly drooping, unsymmetric, oblong-ovoid, 2–2.5 mm. long, 2–1, slightly contracted under the mouth when dry and deoperculate; operculum a little shorter than urn; annulus present, well developed, of at least two rows of cells, easily detachable; segments as long as the teeth, more or less split between the articulation; cilia 2–3, well developed; nodose to short-appendiculate; spores 15–20 μ, nearly smooth, maturing in winter.

On the ground, decaying logs and base of trees. California, Oregon, Washington, Vancouver Id., Idaho, British Columbia.

ILLUSTRATIONS: Sulliv. Bot. Wilkes Expd. Musc. 16. *pl. 13. B.*

EXSICCATI. Sull. & Lesq. Musc. Bor.-Am. (Ed. 2) 434; Macoun, Can. Musc. 298; Ren. & Card., Musc. & Am. Sept. Exsic. 120.

A beautiful species, closely allied to *E. Stokesii;* easily distinguished from that and other species by its large size and regularly pinnate stems.

8. EURHYNCHIUM MYOSUROIDES (Dill. L.) Schimp. Syn. Ed. 1: 549. 1860.

Hypnum myosuroides tenus capsulis natantibus Dill. Hist. Musc. 317, *pl. 41, f. 51.* 1741, and Herb.

Hypnum myosuroides L. Sp. Pl. 1130. 1753.

Isothecium myosuroides Brid. Bryol. Univ. 2: 369. 1827.

Rhynchostegium myosuroides DeNot. Epil. 79. 1869.

Gametophyte in soft intricate light green to brownish green tufts; primary stems creeping, secondary stems 15–25 mm. long, suberect, dendroid and often stoloniferous, frequently becoming arcuate and giving off dendroid innovations like *Hylocomium proliferum;* branching subpinnate to fasciculate; branches often again divided; ultimate branchlets 5–8 mm. long, sometimes flagelliform and much lengthened; branch leaves pluriseriate, often somewhat secund, ovate-lanceolate to oblong-lanceolate, 1–1.3 × 0.25–0.35 mm., acute to-long acuminate, serrulate at apex, sometimes papillose at apex on the back by the thickening of the angles of the cell walls; costa extending to the middle or beyond, sometimes forking; median leaf-cells linear, 5–7: 1; alar cells round-quadrate, incrassate; stem leaves triangular-ovate, long-acuminate, less strongly serrate, basal cells often thick-walled and brown; leaves of primary stems very small, distant, squarrose;

paraphyllia none: dioicous; male branches gemiform, small; inner perigonial leaves ovate, acuminate, concave, ecostate, slightly denticulate; perichaetium 2–3 mm. long, the inner leaves with an ovate-lanceolate sheathing base and a long squarrose-recurved acumination, serrate above, costate. *Sporophyte* 1.5–2 cm. high; seta smooth, twisted to the left above or often irregularly bent, and twisted; capsule brown, oblong-ovoid, suberect, and slightly unsymmetric to horizontal and curved, 2–2.5 mm. long, 3–4 : 1; operculum conic, apiculate to short-rostrate; annulus of 2–3 rows of cells, easily deciduous; segments from a wide basal membrane, as long as the teeth, more or less split along the median line; cilia 2 or 3, nearly as long as the segments; spores minutely roughened, about 16 μ, maturing in autumn or early winter.

Type locality European; type at Oxford in the Dillenian herbarium.

In cool shady places on rocks and roots of trees in alpine and boreal regions. Rare in America. Trinity Bay, Newfoundland, Waghorne; Nova Scotia, James; White Mts. (North Conway) N. H. Oakes.

ILLUSTRATIONS. Dill. l. c.; Br. & Sch., Bry. Eur. *pl. 434*; Wilson, Bry. Brit. *pl. 25*, Dixon & Jam. Handb. Brit. Mosses, *pl. 54. H.*

EXSICCATI. Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 424.

Our eastern plant agrees very closely with the European *E. myosuroides*, but the western form referred to this species is quite different in a number of characters and I believe it should all be referred to *E. stoloniferum* (Hook). The only western specimen examined that seemed at all doubtful was from Guadalupe Island, Lower California, collected by Edward Palmer (no. 115) in 1875. The circumstances were such that the accuracy of this label is doubted.

An exceedingly variable species especially in leaf characters; var. *filescens* Ren. & Card. is a slender form with branches often flagelliform. For the distinctions between this species and *E. stoloniferum* see notes under that species.

9. EURHYNCHIUM STOLONIFERUM (Hook.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876–77: 347. 1878.

Hypnum stoloniferum Hook. Musc. Exot. **1**: *pl. 74*. 1818.

Isothecium stoloniferum Brid. Bry. Univ. **2**: 371. 1827.

Hypnum myosuroides stoloniferum C. Muell. Syn. 2 : 500. 1851.

Hypnum spiculiferum Mitt. Journ. Linn. Soc. 8 : 34. 1865.

Hypnum acuticuspis Mitt. l. c.

Isothecium pleurozoides Kindb. Can. Rec. Sci. 1894 : 19. 1894.

Isothecium obtusatulum Kindb. Can. Rec. Sci. 1894 : 19. 1894. (Roell 117, Vancouver). *Fide* Cardot, Rev. Bryol. 35 : 310. 1896.

Gametophyte in wide, soft, loosely intricate tufts, light green to brownish green, often glossy ; primary stems slender, long-creeping, radiculose, furnished with minute distant leaves ; secondary stems dendroid, suberect, 5 cm. or more long, very much branched ; branches two or three times divided, of varying length, often long-flagelliform, branches and branchlets inclined to one side ; branch leaves varying greatly in habit, spreading to loosely imbricate when dry, sometimes subsecund, 1.5–2 × 0.3–0.4 mm., oblong-lanceolate to ovate-lanceolate, acuminate with point often twisted to the right, serrulate below, coarsely serrate above, smooth or papillose on the back by the thickened angles of the cell walls, margins often slightly revolute below ; costa extending to the middle or beyond, often ending in a spine on the back ; median leaf-cells linear, rather thick-walled, 7–10 : 1; alar cells round-quadrate, incrassate and indistinct ; apical leaves of branchlets attenuate ; leaves of creeping stems scale-like, 0.7 mm. long, narrowly acuminate, subdenticulate, costate to the middle ; leaves of erect stems like those of creeping stems only larger with costa sometimes forking, gradually enlarged and elongated above where they approach the branch leaves in shape and size ; leaves of the flagellae distant, slender, lanceolate, often very long-acuminate, serrate : dioicous ; the inner perichaetial leaves with broad sheathing bases and long-acuminate squarrose apices, serrate above or nearly entire ; costa thin, sometimes wanting ; paraphyses very numerous, long, composed of two or more rows of cells at base. *Sporophyte* much as in *E. myosuroides* ; capsule ovoid, 2–2.5 mm. long, 2.5–3.1.

Type locality, western part of western North America ; Menzies, 1787.

On the ground, trees, and rocks in woods. Apparently common on the Pacific coast. Alaska, Miss Cooley ; Colorado, Shockley.

ILLUSTRATIONS. Brid. *l. c.*; Hook. *l. c.*

EXSICCATI. Macoun Can. Musc. 292 in part, 291 (*Isothecium myosuroides*), 293 (*Hypnum spiculiferum*), 656 (*Isothecium pleurozoides*).

An exceedingly variable and perplexing species. The papillose character of the leaves is of no value whatever as a distinction, as the leaves of European *E. myosuroides* are frequently papillose and this character varies even on leaves of the same plant. I have seen type specimens of *Hypnum acuticuspis* Mitt. and *Hypnum spiculiferum* Mitt. The specimens of *H. spiculiferum* were larger and had larger, longer acuminate, more strongly acuminate leaves on the secondary stems than is usually the case with *E. stoloniferum*, but there were two well developed cilia with rudiments of a third. It appears to be a well-developed form of *E. stoloniferum*. *Isothecium pleurozoides* is a broad leaved form varying in the direction of var. *myurellum*.

E. stoloniferum differs from *E. myosuroides* in its larger size, more frequent and better developed flagellate branches, in the longer branch leaves with a broader and more gradually narrowed acumination, and broader and longer median cells. The stem leaves also are slightly rounded at the basal angles, as broad as long and narrowed to a comparatively long slender acumination.

9a. EURHYNCHIUM STOLONIFERUM CARDOTI (Kindb.).

Isothecium Cardoti Kindb. Bull. Torr. Bot. Club, **17**: 278. 1890.

Bright glossy yellow-green; secondary stems irregularly pinnately branching, 5–10 cm. long, sometimes bearing long rigid flagellae at the ends; branch leaves reaching 3 mm. in length by 0.7 mm. in breadth.

A beautiful variety representing the maximum development of the species. So large and striking is it in appearance that at first sight one feels that it must surely be a distinct species, but there is a whole chain of common and intermediate forms. The species itself is one of the most variable species known to me, thus making it impossible to base a distinct species on a form whose principal difference is mere size. It is possible that *E. stoloniferum* itself should be regarded as a subspecies of *E. myosuroides*, but some specific lines seems imperative between such divergent forms as the European *E. myosuroides* and *Isothecium Cardoti* Kindb.

Type locality, Hastings, B. C. On base of trees and logs. Victoria, Vancouver Id.; Washington.

EXSICCATI. Macoun, Can. Musc. 394.

9b. EURHYNCHIUM STOLONIFERUM MYURCELLUM (Kindb.).

Isothecium myurcellum Kindb. *l. c.*

Branches seldom flagelliform, having a much smoother subjulaceous appearance due to the shorter, more appressed leaves; branch leaves ovate-lanceolate to ovate-elliptical, obtusely acute to short-acuminate, 1–1.2 × 0.3–0.4 mm., coarsely, often doubly, serrate above, concave; median cells 5–7 : 1, the upper shorter and broader; apical cells rhombic-elliptical, 2–3 : 1; round-quadrate alar cells more numerous.

On stones and decaying logs.

Type from Victoria and Nanaimo Rivers, Vancouver Island.

Colorado, Shockley; Vancouver Island, Macoun; Marin and Sonoma Counties, California, M. A. Howe.

EXSICCATI. Macoun, Can. Musc. 397, and 292 in part.

By reason of its habit and short pointed branch leaves with well differentiated apical cells, this variety also seems a good species at first sight, but all the intermediate forms of leaves can frequently be found in the same tuft and sometimes even on the same plant.

DOUBTFUL SPECIES.

EURHYNCHIUM DAWSONII Kindb. Bull. Torr. Bot. Club, **17**: 278. 1890.

Gametophyte in thin intricate mats, dirty green, branches tipped with bright somewhat glossy green leaves; branch leaves loosely intricate, slightly or not at all decurrent, ovate, more or less long-acuminate, concave, serrulate above, margins slightly reflexed at base, 1–1.2 × 0.5 mm.; costa very stout, extending four-fifths length of leaf; median cells oblong-linear, 6–8 : 1; area of quadrate alar cells large. Sporophyte not seen.

Described from a specimen bearing this label, "On stones in ditch west side of Black's Hotel, Hastings B. C., April 29, 1889."

Resembling *E. crassinervum* in the stout costa, broad leaf-cells and numerous quadrate alar cells; differing in the slender habit and smaller ovate branch leaves.

The following is the original description:

"Stems densely pinnate, not or rarely radiculose; branchlets patent. Leaves green or brownish, not glossy, not or indistinctly papillose, not long-acuminate from the broad ovate base, recurved on the borders below, long-decurrent, open-erect, denticulate all around, areolation variable, often sub-rhomboidal; costa thick, reaching nearly to the apex. Probably dioicious."

"Allied to *E. hians* and *E. Sullivantii.*"

"On rocks along the Nanaimo River below the railway bridge, Nanaimo, Vancouver Island, April 27, 1887."

EURHYNCHIUM PSEUDO-VELUTINOIDES Kindb. Rev. Bryol. **22**: 84. 1895.

"Leaves not or slightly striate, distant, subulate-acuminate and filiform pointed, faintly reflexed near the base. Stem leaves subobovate or ovate-oblong, entire; costa scarcely reaching to the middle. Branch leaves ovate-lanceolate, denticulate all around; costa reaching somewhat above the middle. Perichaetial leaves with a very long filiform point. Capsules not found: pedicel rough. Tufts loose and green. Stems pinnate, not creeping. Leaves patent or spreading when dry. Probably monoecious."

"Canada, Vancouver Island, earth (1893): Macoun."

No specimens available and original description quoted.

EURHYNCHIUM CRASSINERVIUM (Tayl.) Br. & Sch. var. LAXORETE Kindb. Macoun, Cat. Can. Pl. **6**: 207. 1892.

"Differs in the leaves being nearly entire or faintly denticulate above, shorter acuminate and the cells larger. Only male flowers found."

"On earth in woods at Canaan Forks, Queen county, New Brunswick. J. Moser."

No specimens available and original description quoted.

EXCLUDED SPECIES.

Eurhynchium subintegrifolium Kindb. Ottawa Nat. **7**: 21. 1893.

Specimens from "earthy banks by the sea, Comox, Vancouver Island, no. 146b (sterile); coll. J. Macoun" have the costa short and double and certainly are not referrable to this genus.

Eurhynchium pseudo-serrulatum Kindb. Ottawa Nat. **7**: 22. 1893. = *Brachythecium Starkei.*

Eurhynchium semiasperum C. M. & Kindb. Macoun Cat. Can. Pl. 6: 207. 1892. = *Brachythecium plumosum.*

The remainder of Kindberg's new species of *Eurhynchium* belong, according to his own classification, to groups that are not here included in *Eurhynchium.*

Eurhynchium colpophyllum Sulliv. is a *Scleropodium, S. colpophyllum* (Sulliv.).

Hypnum lentum Mitt. appears to be a *Scleropodium* also, *S. lentum* (Mitt.).

About *Hypnum apocladum* Mitt. nothing further is known and it is doubtful to what genus it should be referred.

Hypnum Brewerianum Lesq. certainly does not belong in *Eurhynchium.*

Hypnum aggregatum Mitt. is a synonym for *H. Brewerianum* Lesq.

Isothecium Howei Kindb. Rev. Bryol. **22**: 82. 1895, is probably nothing but a variety of *H. Brewerianum.*

New Plants from New Mexico.—I.

By E. O. Wooton.

A portion of the summer of 1897 was spent by my wife and myself in central southern New Mexico collecting plants. Between June 14 and September 10 we traveled in a wagon from Mesilla nearly to Fort Stanton and back, camping wherever it was most convenient and collecting as we went. The country visited is interesting botanically and a part of it has, so far as I know, never been visited by any botanist except myself.

The Mesilla Valley, in which now lie Las Cruces ("Crucis") Mesilla, Doña Ana and the ruins of old Fort Fillmore referred to in the Botany of the Mexican Boundary Survey, is but a broadening of the flood plain of the Rio Grande; it is partly under cultivation and is composed partly of flats of more or less alkaline adobe soil and partly of low sand hills.

Twelve miles east of the valley and running nearly parallel to it are the Organ Mountains visited in the early fifties by Mr. Charles Wright and Dr. Bigelow. This range of mountains is narrow, rugged and precipitous, with little water and comparatively few trees.

East of the Organs (and their northern extension, the San Andreas Mountains) lies an almost flat plain, fifty to sixty miles wide and bounded on the eastern side by the Sacramento and White Mountains. This plain is a treeless and apparently barren stretch of mesa, lowest near the middle, where the altitude is about 4000 feet above the sea level.

The only water is very strongly alkaline and is found at three wells near the middle of the plain and a few miles south of a very peculiar and extensive deposit of gypsum known as the "White Sands."

The White Mountains are in Lincoln County almost due northeast of the Organs and about ninety miles away. They cover several hundred square miles of area, receive considerable infall, are watered by several small streams, have heavy forests of pine and Douglas spruce with a sprinkling of oaks and a very interesting herbaceous flora.

Of the whole time in the field nearly one month was spent in and about Mesilla, about two weeks in the Organ Mountains, nearly one week at the White Sands and the remainder at various places in the White Mountains from Tularosa, at the southwestern base of the range, to the Mescalero Indian Agency, Ruidoso Postoffice, Gilmore's Ranch on Eagle Creek, and finally to the top of Sierra Blanca Peak.

The result of the trip was the collection of numerous interesting and not a few rare plants, while the following are some of the new species discovered:

LEPIDIUM EASTWOODIAE.

Perennial with ligneous base from which arise one to several erect stems 6–10 dm. high, which branch corymbosely at the top; branches terminated by many-flowered racemes: basal and lower stem leaves 3–5 cm. long, pinnately divided into oblong acute segments which are entire or few-toothed, upper cauline leaves narrowly oblong-lanceolate, acute, entire or occasionally with a few lobe-like teeth, 2–6 cm. long and 2–8 mm. broad, not revolute, all leaves thin, dark green and glabrous: rachis and pedicels pulverulent; pedicels in fruit 5–7 mm. long, spreading, about 2 mm. apart on the rachis; flowers bright white, crowded in a rounded cluster at the top of the raceme: sepals elliptic, 1 mm. long, greenish white, glabrous, deciduous before the petals: petals elliptic, 3 mm. long, claw 1 mm. long: stamens tetradynamous: pod elliptic-ovate, emarginate, tipped by the style which is scarcely longer than the emargination.

Described from plants collected at the Mescalero Agency in the White Mountains, Lincoln County, July 26, at an altitude of 6300 feet.* No. ~~672.~~ 673.

I became acquainted with this plant in the fall of 1890 when I collected it at the Organ Mountains. I have named it in honor of Miss Alice Eastwood, curator of the Herbarium of the California Academy of Science, who first called my attention to the fact that it was probably distinct from *L. alyssoides* Gray.

This plant is most nearly related to *L. alyssoides*, from which it

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[*] The altitudes here given are from uncorrected aneroid readings and have a possible error of 150 feet or less.

is difficult to separate it without the best of dried material. The characters which are of most importance are its size and habit, and thinner darker green foliage, the cauline leaves being much broader and the pinnatifid leaves being more numerous and not wholly basal. Normally it grows in rather heavy soil producing erect simple stems 5–8 dm. to the first branch. Plants of the first year produce but a single stem and might easily be taken for annuals.

In the Organ Mountains old plants are quite frequently found growing in cracks in vertical cliffs, and in these situations the stems grow out at all angles and curve upward. I have seen well grown plants of this kind forming hemispherical masses of green and white a meter in diameter upon the face of a perpendicular rocky wall.

LEPIDIUM THURBERI

Annual (?) corymbosely much branched from near the base up the stout central erect stem, 3–4 dm. high; stems and leaves villous-hirsute with coarse white hairs, which are very numerous upon the young parts: leaves all pinnatified, segments ovate to oblong-elliptic, acute, entire or variously toothed in the lower leaves: inflorescence of numerous corymbosely arranged many-flowered racemes, 2 dm. or less long; flowers bright white, crowded at the top of the rachis; pedicels in fruit 5 mm. long, ascending: sepals ovate, concave, 1.5 mm. long, glabrous, green with white margin: petals elliptical, 2–3 mm. long, short-clawed: stamens tetradynamous, filaments subulate, 2–3 mm. long, anthers elliptical: pod elliptical to rotund, glabrous, emarginate, tipped by the scarcely 1 mm. long style.

Collected at Lava, June 11, while passing through on the train. No. 672.

Alt. 4200 ft.?

First collected by Dr. Geo. Thurber, at the copper mines, near what is now Silver City, in 1851 (no. 323), for whom it is here named. Also collected by Dr. H. H. Rusby, near Prescott, Ariz., May 18, 1883, and by Dr. T. E. Wilcox, at Fort Huachuca, Oct. 1892.

This plant has until now been included in *L. montanum* Nutt. which is caespitose, "nearly glabrous, decumbent" and has its upper leaves entire and comes from the extreme northwestern part of the United States.

LESQUERELLA AUREA.

Annual, sending up several erect or slightly spreading stems 3–4 dm. high, each terminating in a raceme of bright yellow flowers: leaves narrowly obovate to oblanceolate, 1–3 cm. long, 3–10 mm. broad, upper ones oblong, decurrent, subsessile, obtuse, entire to slightly sinuate-dentate; leaves, stems and outside of sepals covered with a close fine soft stellate pubescence, tomentulose on the younger parts of the inflorescence: flowers in terminal racemes, crowded at the end of the rachis, the latter elongating in fruit; proper peduncle about 1 cm. long, rachis (in specimens which have only a few mature pods) 1 dm. long; pedicels 3–6 mm. long in flower, ascending, 10–12 mm. long in fruit, strongly recurved: sepals oblong, obtuse, 3 mm. long, yellowish: petals obovate-spatulate, 5 mm. long, half as broad, blade decurrent into a kind of winged claw: filaments subulate, anthers sagittate: ovary glabrous, containing 3–8 pendulous ovules: pod globose, 3 mm. in diameter, not stipitate, glabrous, tipped by the 2–3 mm. long persistent style; seeds 2–5 ovoid, light brown.

Collected on the south fork of Tularosa Creek three miles east of the Mescalero Agency in the White Mountains at an altitude of about 6500 feet on hillsides, July 30. No. 245.

This species is properly classed in the same group with *L. recurvata* (Engelm.) Wats. and should follow that species, being somewhat intermediate between it and *L. Lindheimeri* (Gray) Wats. It is easily distinguished from the latter by its strongly recurved fruiting pedicels, its less dentate leaves, slender stems, smaller flowers and softer, not lepidote pubescence. From *L. recurvata* it is separated by stouter, erect, simple (?) stems (the stems in my specimens are not branched but short branches are beginning to appear in the upper axils, indicating that they may branch somewhat as in *L. recurvata*) much larger leaves, terminally clustered and more numerous flowers and the peculiar soft pubescence which is not lepidote or scabrous.

MENTZELIA PERENNIS.

Perennial; stems caespitose, erect or slightly spreading, branched above, scabrous with retrorsely barbed hairs or almost glabrous, bark thin and white: leaves alternate, linear, 3–10 cm. long, 2–3 mm. wide, entire or with 10 or less, rounded tooth-like lobes, 2–5 mm. long, scabrous with barbed hairs: flowers terminal or in the upper axils producing a pseudo-cymose inflorescence; peduncles about 1 cm. long, subtended by small leafy bracts: calyx-tube turbinate, 5 mm. long, limb of 5 subulate segments 1 cm. long, scabrous, an indurated ring forming at the base of the segments: petals 10, oblanceolate, acute, entire, light lemon-yellow, 2 cm. long, the outer five 5 mm. broad, the inner a little narrower: stamens numerous, five outer filaments slightly expanded, same length as petals, inner ones shorter: style 1 cm. long; stigma 3-parted, minutely ciliate: pod campanulate-cylindric, barely 1 cm. long, 4 mm. in diam. when nature, with persistent calyx-lobes variously arranged, scabrous, placentae 3, parietal, strongly horizontaly laminated; seeds numerous, flattened elliptic-orbicular, winged.

Collected in a white soil (strongly impregnated with gypsum?) at Round Mountain, half way from Tularosa to the Mescalero Agency in the White mountains. July 21. Altitude 5400 feet. No. 184.

This species belongs to the group containing *M. multiflora* (Nutt.) Gray and *M. pumila* T. & G., and is, judging from the description of that species, closely related to *M. densa* Greene, but distinct from it as Prof. Greene assured me when shown my specimens.

MENTZELIA RUSBYI.

Erect, annual (?) 1–1.5 m. high, branched above: stem stout, scabrous, becoming glabrous, white: lower leaves long-lanceolate, 2 dm. long or less, 15 mm. wide, attenuate into a petiole, upper ones oblong-lanceolate, 4–10 cm. long, 1–2 cm. broad, sessile, acuminate, sinuate-dentate with a few large sharp teeth, very rough with barbed hairs: flowers in terminal cymes: calyx-tube clavate, 8–10 mm. long, bearing two pinnatifid bracts at its base; segments of the limb narrowly lanceolate, acuminate, 10–12 mm. long, 3 mm. broad at base: petals 10, light yellow, the outer five narrowly obovate to oblanceolate, 16–20 mm. long, 4–6 mm. broad, acutish, the inner five a little narrower and shorter, and tipped with rudimentary anthers: stamen numerous, 6–12 mm. long, a few of the outer filaments slightly detailed: style 1 cm. long; stigma 3 cleft: capsule clavate-cylindric, 3 cm. long, 1 cm. in diameter, striate, scabrous; seeds numerous, flattened, ovate, winged.

Collected at the Mescalero Agency in the White Mountains July 26, at an altitude of 6300 ft., no. 210. First collected by Dr. H. H. Rusby at Bellmont, Ariz., September 2, 1883 (no. 614), for whom the species is here named.

Its affiliations are with *M. Wrightii* Gray, from which it can be separated by its larger size, larger leaves which are sharply toothed and not at all pinnatifid, and by the much larger flowers, and *M. nuda* (Pursh) T. & G., which has smaller, more finely toothed leaves and still larger flowers.

CONANTHUS (?) CARNOSUS.

Perennial root; stems several and much branched forming a rounded mass 3–4 dm. high, fleshy (shriveling much on drying) canescent with matted more or less appressed stiff white hairs; leaves linear, 2–4 cm. long, 1–2 mm. broad, fleshy and so strongly revolute as to appear terete, obtuse, strongly hispid; whole plant of a peculiar yellowish green color not shown in the dried material: inflorescence cymose, pedicels 2–3 mm. long, each flower subtended by a linear leaf-like bract: sepals linear, obtuse, 7–10 mm. long, hispid, little united at the base, persistent: corolla ochroleucus, tubular, slightly exceeding the sepals, constricted at the throat, pubescent; limb of five strongly reflexed oval repand segments, 1–2 mm. longer, throat not personate, glabrous: stamens 5, alternate with corolla lobes, filaments inserted at slightly different heights on the tube, each decurrent into two wing-like margins at the base, which are not free at the tips as in *Phacelia;* anthers ovate, included: styles two, free their entire length, peristent, spreading, villous at the base; stigmas capitate; ovary two-celled by the intrusion of the placenta which is thickened and pseudo-central, but breaks away with the two valves; disk not very prominent: pod oblong-ovate, pubescent; seeds numerous (about 50) horizontal, irregular from crowding, brown, reticulate pitted under high power.

Collected on the White Sands July 17. Altitude 4000 feet. No. 164.

This plant is most nearly related to *Nama stenophyllum* Gray, with which, however, it will hardly be confused. As to whether it should be called *Conanthus* or *Marilaunidium* I am not at present able to decide, having nothing but a description of the former genus at hand.

VERBENA PERENNIS.

Suffrutescent perennial, 3–4 dm. high, with numerous erect or ascending striate-angled stems: leaves linear, the lowermost occasionally pinnately few-lobed, 1–2.5 cm. long, 2–3 mm. wide, erect or ascending, entire, margins revolute; leaves and stems sparsely covered with short sharp stiff upwardly-pointing hairs: spikes terminating the stems and branches, loosely many-flowered: flowers small, 7–8 mm. long, sessile, each subtended by an ovate persistent bract 3 mm. long and glabrous above: calyx 4 mm. long, tubular, herbaceous ribbed, ribs pubescent, hyaline and glabrous between the ribs, teeth short-triangular, equal, acute: corolla deep blue, tube slightly longer than the calyx, expanded just below the throat, forming a ring in which the almost sessile anthers lie, throat filled with hairs; the limb 5-parted, bilabiate, lobes elliptical, repand: style short, included, stigma unequally two-lobed, clavate: fruit four cylindric glabrous reticulated brownish nutlets, minutely retrorsely scabrous on the commissure, enclosed in the persistent calyx, 5–7 mm. apart on the rachis.

Found growing in crevices of rocks along the road about two miles west of the Mescalero Agency in the White Mountains, July 21. Altitude 6000 feet. No. 187.

This species is most nearly related to *V. canescens* H.B.K. var. *Neo-Mexicana* Gray, but may be easily separated from that variety (?) by the linear, generally simple revolute leaves and the peculiar pubescence.

MONARDA STRICTA.

Aromatic perennial: stems erect, little or not at all branched, quadrangular with rounded angles, reddish tinged, 5–8 dm. high, standing alone or in clumps arising from creeping underground stems, internodes generally longer than the leaves: leaves opposite on petioles 1 cm. long or less, ovate- to triangular-lanceolate, 4–6 cm. long, 1–2 cm. wide, acuminate, a few sharp serrate-dentate teeth along the sides but the acumination entire, base rounded or truncate, not cordate; whole plant canescent with minute curved hairs, glabrate upon the upper surface of the leaves which is slightly darker green: flowers in a single terminal involucrate head, short pedicelled. bracts of the involucre leaf-like, elliptic-ovate, short-acuminate, rose purple above, 1–2.5 cm. long, floral bracts linear-subulate, hispid on margins: calyx tubular, 13-ribbed, 7–10 mm. long, limb of five equal subulate teeth 1–2 mm. long, throat densely white or purplish hirsute within, a tuft of stiff spreading hairs in each sinus of the limb: corolla bright purple, becoming bluer with age, strongly bilabiate, upper lip linear, straight, lower lip 3-lobed, lateral lobes broad, repand, middle lobe oblong, entire corolla except the middle lower lobe villous on the outside, upper lip not more so at the tip: stamens two, exserted with pistil from under the upper lip: ovary with 4 rounded lobes, glabrous; mature fruit not seen.

Collected on the divide, nine miles northeast of the Mescalero Agency in the White Mts., August 1. Alt. 7000 ft. No. 267.

This is *M. fistulosa* L. var. *mollis* (L.) (Mearns no. 86. Mogollon Mts. Ariz., July 13, 1897) of Britton in N. Y. Acad. Sci. **8**: 71. 1889, Not Benth.; and Heller's no. 3798, distributed as *M. Lindheimeri* Engelm. & Gray, from near Santa Fé, N. Mex., July 2, 1897. Alt. 8000 ft. It was collected by Mrs. R. W. Hoyt at Ft. Apache, Ariz., in 1893 (*M. scabra* Britton *l. c.* **14**: 40. 1894. Not Beck.), and by myself in the White Mts., N. Mex., at about 6800 ft., July 3, 1895.

It has passed as *M. scabra* Beck, to which it is most closely related. It may be distinguished by its darker colored flowers, its strict unbranched stem, its longer internodes and generally narrower not cordate leaves.

New Plants from Western North America.—II.

By A. A. Heller.

Thelypodium sagittatum (Nutt.).

Streptanthus sagittatus Nutt. Journ. Acad. Phila. **7**: 12. 1834.

Thelypodium Nuttallii Wats. Bot. King Exped. 26. 1871.

Dr. Watson recognized the fact that the specific name *sagittatum* could not be used for two different species in the genus *Thelypodium*, but unfortunately he gave a new specific name to the older plant, and kept up the name of *sagittatum* for the later published *Pachypodium sagittatum* Nutt. On page 26 of the King Expedition Report, he says the plant was "Collected by Nuttall in Southern Idaho," a statement which does not seem to be borne out by the fact, for the paper in which this species is described, is entitled "A Catalogue of a Collection of Plants made chiefly in the Valleys of the Rocky Mountains or Northern Andes, towards the sources of the Columbia River, by Mr. Nathaniel B. Wyeth, and described by T. Nuttall."

Thelypodium torulosum.

Pachypodium sagittatum Nutt.; T. & G. Fl. N. A. **1**: 97. 1838.

Thelypodium sagittatum Endl.; Walp. Rep. Bot. **1**: 172. 1842.

As stated above, this is the species to which Watson should have applied a new specific name, instead of giving it to the earlier published species. The original locality of this species is "Plains on the west side of the Rocky Mountains." I have given it the specific name *torulosum*, in reference to the torulose pod.

Lupinus Hellerae.

Perennial; stems several, growing in clusters from a stout rootstalk, erect, 3–3.5 cm. high, sericeous, as are also the petioles and both sides of the leaflets, or the hairs on the lower part of the stem and petioles somewhat spreading; leaves numerous, basal, or the flowering stem bearing one or two; petioles 10 to 15 cm. long, their bases dilated; leaflets seven to nine in number, usually eight, oblong-lanceolate, with tapering base, 4–4.5 cm. long, 5 mm. wide when mature, the apex acutish and mucronate, mid-vein yellowish, prominent beneath; stipules narrowly linear-lanceolate, about 7 mm. long; flower stalks scapose, the flower bearing part 15 cm. long; flowers rather large, deep indigo blue, 1 cm. in width, and nearly 1.5 cm. long, verticillate, the internodes usually short; bracts narrowly lanceolate, barely half the length of the calyx; calyx sericeous, not spurred, not quite half the length of the corolla, unequally cleft, the upper lobe slightly shorter, and again two-cleft, its lobes obliquely lanceolate; the lower lobe lanceolate, entire, strongly concave; banner glabrous, bearing a light spot on the inner face, keel bearded on the inner side near the apex.

The type is no. 3080, collected opposite the Central Ferry, four miles east of Lewiston, Nez Perces county, Idaho, May 18, 1896, altitude 800 feet. The specimens were obtained in low, sandy and gravelly ground, on the banks of the Clearwater river, formerly known as the "Kooskoosky," where it grew in large patches, the hundreds of plants, with their bright blue flowers, presenting a very attractive appearance. It is with pleasure that I dedicate this beautiful species to my wife, Mrs. E. Gertrude Heller, who assisted in gathering the specimens.

This species was collected by Sandberg, MacDougal and Heller in 1892, at a point four miles further up the river, where it grew on an island, in sand and gravel near the water's edge. It is their no. 120, determined as "*Lupinus lepidus* Dougl." by Mr. Holzinger, in Cont. U. S. Nat. Herb. 3: 219. An albino form was also collected at the same time, growing in company with plants of ordinary color. Mr. Holzinger also gives the wrong habitat, for he says, "On Peter creek near Upper Ferry, Clearwater river, above Lewiston." It may be stated that the habitat which he gives to no. 120 belongs to no. 99, and the "island in Clearwater river" under no. 99, belongs to no. 120, but not the "grassy hillsides," for the islands are almost level. Also, no. 99 is not "*Lupinus Burkei* Wats." as determined by him, but is *Lupinus Wyethii*. In 1892 it was collected by the writer on hillsides along Peter creek, and again in 1896 in similar situations along the Clearwater river.

Lupinus Hellerae is, perhaps, common along the Clearwater, but I have seen it only at the two places mentioned, and nothing like it seems to be in any of the herbaria, so far as I know. It is related to *L. lepidus* in a general way, but very distinct, as is apparent by referring to the original description and the accompanying plate in the Botanical Register.

HYDROPHYLLUM ALBIFRONS.

Hydrophyllum Virginianum Holzinger, Cont. U. S. Nat. Herb. 3:241. 1895. Not L.

Perennial; stem moderately stout, 4–6 cm. high, more or less hirsute; leaves all on stout petioles, those of the root leaves dilated at the base, slightly clasping, those of the stem confluent with it for a considerable distance, the blade 10–16 cm. long, 10–12 cm. wide; leaflets in three or four subopposite pairs, exclusive of the three-lobed terminal segment, more or less decurrent, ovate-lanceolate in outline, acute, usually two-lobed, and coarsely serrate, light green when fresh, hirsute above with appressed hairs, clothed beneath with soft white short hairs; inflorescence equalling or slightly exceeding the subtending leaf; peduncles stout, grooved, densely wooly, cymes compact: calyx half the length of the petals, very pubescent, parted almost to the base, the lobes linear-lanceolate, acute, heavily fringed with long white wavy hairs: corolla cream-colored, or faintly tinged with purple, about 1 cm. long, puberulent, especially on the lower half, the lobes broadly oblong, obtuse, notched.

The type is no. 3269, collected June 20, 1896, in the woods at the head of Lake Waha, Nez Perces county, Idaho, altitude 2000 feet. Several dozen plants were growing in an open, grassy place near a stream. The white appearance of the leaves is somewhat lost in dried specimens, but is conspicuous in the living plant.

No. 112 of Sandberg, MacDougal and Heller, wrongly referred to *H. Virginianum*, by Mr. Holzinger, belongs to this species. These specimens were collected by the writer at two stations, in the Clearwater valley, once on the banks of Peter creek, under a clump of willows, and again in similar situations along the Lapwai.

To this species are also referred two specimens from the State of Washington. One was collected at Pullman, May 31, 1893, no. 1697, by Prof. C. V. Piper, and labeled "*Hydrophyllum occidentale.*" The other was collected by Sandberg and Leiberg at Stevens Pass, August, 1893, labeled "*Hydrophyllum Virginianum.*" The leaflets in these specimens from Washington are longer and sharper than are those of the type specimen.

CASTILLEJA LUTEA.

Perennial, clothed throughout with lanate pubescence; stems clustered, 20–30 cm. high: basal and lower stem leaves lanceolate, narrow, those of the upper part of the stem oblong, or somewhat obovate, the upper half, or third, usually three-lobed, all of the lobes lanceolate, but the lateral ones narrower and acuminate, the middle one usually again three-lobed, with its lateral segments narrower; floral bracts pale yellow, or the tips somewhat purple tinged, more unequally toothed or lobed than the foliage leaves, the terminal segment broad and rounded, the others narrowly lanceolate; calyx oblong, about 3 cm. long, equally cleft before and behind, the lobes about equalling the tube, slightly dilated and notched at the blunt apices; corolla barely exserted, the galega equalling or a trifle shorter than the tube, faintly tinged with purple, or yellow.

The type is no. 3267, collected May 20, 1896, on grassy hillsides near the mouth of the Potlatch river, Nez Perces county, altitude 1200 feet. It is also abundant on the plateau below Lake Waha. It may be looked for in herbaria under the mixture called "*Castilleja parviflora* Bong.," although I have never seen any other specimens. It is found growing with this other species, but can be distinguished from it at a glance. It is a smaller plant than the so-called *parviflora*, and has an entirely different kind of pubescence.

Our specimens somewhat resemble the type of *Euchroma Bradburii* Nutt., preserved in the herbarium of the Academy of Natûral Sciences, Philadelphia, but is apparently not the same, so far as can be ascertained from that poorly prepared and fragmentary specimen.

C. lutea may possibly be the same as *C. desertorum* Geyer, published by Hooker as a synonym of *C. hispida*, in Journ. of Bot. and Kew Garden Misc. **5**: 258. 1853, where the following is given: "Prairie plateaus of the Nez Perces Mountains. * * * Except in color, I do not see how these specimens of Mr. Geyer's *C. desertorum* (no. 511) differ from what I consider to be a mere form of *C. hispida* (no. 377); but when living, characters probably manifest themselves."

As he gives no description whatever, and does not even mention the color which is said to be the sole difference, the name is a *nomen nudum* and we have no other clue than that of locality. The species apparently has its home on this plateau below Waha, for it is very abundant there.

In the second line from the bottom of page 296 of Vol. 2, Part I., of the Synoptical Flora, occurs this statement: "*E. angustifolia* Nutt., l. c., a low and small-flowered subalpine form; same as *C. desertorum* Geyer." If Dr. Gray actually saw this plant of Geyer's and also Nuttall's there is no ground whatever for supposing that our plant may be identical with Geyer's, for I have seen the type of Nuttall's *Euchroma angustifolia*, and it is very distinct from ours, as is also indicated by his original description in Journ. Acad. Phila. **7**: 46. 1834.

VALERIANA OCCIDENTALIS.

Rootstalk moderately stout, ascending, somewhat branched; roots numerous; stems rather stout, 6–8 dm. high, puberulent, especially below; basal leaves ordinarily about 25 cm. long, elliptical-lanceolate, bluntly pointed, the petioles occupying more than half of the total length; stem leaves on short clasping petioles, which are ciliate on the lowest pair, ovate-lanceolate in outline, the lower ones 10–12 cm. long, and composed of about four pairs of leaflets, these lanceolate and acute, the lowest pair the smallest, while the single terminal leaflet is several times larger than those of the pair next beneath it; inflorescence much elongated, composed of from three to five pairs of opposite branches, the lowest internode about 12 cm. long, the others growing successively shorter; the lowest flower branches subtended by a bract-like leaf, which is parted into three linear-lanceolate lobes, the other flower stalks provided with narrow linear bracts; flower branches approximately as long as the internodes, surmounted by a three-branched cyme, each branch of which is again subdivided into two or three branches, the pedicels slightly pubescent or puberulent; calyx glabrous, the lobes linear-lanceolate, prominently one-nerved; corolla creamy white, short, with barely half its length exserted from the calyx, the tube only half the length of the throat and limb; stigma entire.

The type is no. 2353 3353!, collected July 2, 1896, near the western end of the Craig Mountain plateau, above Lake Waha, Nez Perces county, Idaho, altitude 3500 feet. The plants were growing in rich ground in an open place in the woods.

Valeriana occidentalis was probably distributed by me under the names of *V. sylvatica* or *V. Sitchensis*, and some few perhaps as "*V. montana* n. sp.," for I had intended to adopt the latter name, not knowing at the time that it had already been used in this genus.

ERIOPHYLLUM PEDUNCULATUM.

Stems several, simple, erect from a slender perennial rootstalk, 3–5 cm. high, reddish below, sparingly floccose, leafy; leaves alternate or sub-opposite, oblong-lanceolate, narrowed at the sessile, somewhat clasping base, mature ones 5 cm. long, 1 cm. broad, entire, or undulate-denticulate, acute, the margins incurved on the lower side, which is covered with floccose tomentum, midvein prominent, yellowish, upper side less floccose and sometimes almost glabrous; upper part of stem naked, forming a peduncle 5–15 cm. long; heads nearly 1 cm. high, about 2 cm. across when expanded; involucre lanate, firm and coriaceous, the divisions eight in number, lanceolate, keeled, the short-acuminate tips recurved; ray flowers oblong, orange yellow, about 1 cm. long, 4 mm. wide, three-toothed; disk flowers colored as are the rays, glandular pubescent on the outside, the lobes very short, triangular-lanceolate; anther tips ovate, obtuse; akenes cuneate-linear, glabrous.

The type is our no. 3390, collected in a dry, open place in the woods on the left bank of the Sweetwater, almost opposite the head of Lake Waha, Nez Perces county, Idaho, altitude about 3000 feet. The specimens were obtained along the ditch which leads from the Sweetwater to the lake, and were growing on a steep slope, among grass and small bushes.

This species seems to belong to Gray's section *Trichophyllum* and is probably part of his composite *Eriophyllum caespitosum*, but certainly distinct from any of the forms described by him. It may be part of his *E. caespitosum* var. *leucophyllum*, but does not at all agree with *Bahia leucophylla* of DeCandolle. I have distributed it as "*Eriophyllum integrifolium*," a plant since raised to specific rank by Professor Greene, and as I now understand it, nothing like this species.

ERIGERON CONCINNUS (H. & A.) T. & G. Fl. N. A. 2: 174. 1841.

Ditasis ? concinna H. & A. Bot. Beechey, 350. 1840.

Our no. 3229, collected on gravelly hillsides along the Clearwater river, near Lewiston, Idaho, seems to me to be typical

Erigeron concinnus. It was first thought to be a new species, and was distributed without specific name. It is not at all like the specimen in the herbarium of Columbia University, which Dr. Torrey seemed to think was *E. concinnus*, neither is it the same as much of the material which passes for this species. A careful inspection of the original description by Hooker & Arnott, convinces me that our Idaho plant is the same as theirs, and in that case the bulk of the so-called *E. concinnus* belongs to some other species, or is still undescribed. The following is the original description of *Ditasis ? concinna* :

"Toto pilis albidis patentissimis canescenti-strigosa, radice perenni collo multicipiti, caulibus erectis gracilibus angulatis ramosis, foliis linearibus basi attenuatis radicalibus sublonge petiolatis, involucri foliolis subulatis albidis dorso viridibus, radii flosculis uniserialibus numerosis anguste linearibus disco duplo longioribus, pappo conformi biserali, serie ext. brevi paleaceo, int. 8–10 setoso."

"Of the genus of this most beautiful plant, we are uncertain. The slender stems, scarcely a span high, the copious foliage, peduncles and involucres, are everywhere hoary with harsh white spreading hairs. The flowers are about the size of a daisy ; the rays bright blue, in the dried plant, and the disk, yellow. The outer pappus consists of five or six lanceolate short palae ; the hairs of the inner row are equal in thickness throughout."

Our specimens are slightly over a "span" in height, as a rule, although not always so, and are covered with a profusion of beautiful, bright blue flowers. They also answer throughout to the above description. The original was collected on the "Snake River, below the Salmon Falls, Snake Country," by Mr. Tolmie. The Salmon Falls are some 250 miles southeast of Lewiston, but apparently in the same basalt formation.

UNIVERSITY OF MINNESOTA,
Minneapolis, Minn.

Heat of Imbibition by Seeds.

BY GEORGE MACLOSKIE.

The explanation of the production of heat in germinating seeds by destructive metabolism, with the production of carbon dioxide, is only part of the case; and fails at the initial step, where the necessity is greatest. Nor will it suffice to supplement our explanation by suggestions of rising temperature of the atmosphere or of the soil; for in some cases germination has occurred at low temperatures, even at the freezing point of the soil.

A supplementary, or rather a preliminary source of warmth may be found in the discovery by botanists of a physical law, which though not much discussed by either botanists or physicists, seems to have large application to problems that meet us in all branches of investigation. Sachs informs us * that heat is set free when water enters into organized, and, to a smaller extent, unorganized bodies; stating that according to Pfeffer this was first established by Pouillet, and that in 1865 it was confirmed by Jungk and himself. Nägeli's experiment on this consisted of drying flour-starch, so as to deprive it as far as possible of all water, and then immersing some of it in an equal weight of distilled water, which resulted in a rise of 11.6° C. †

Sachs applies to this result Joule's estimate that 0.03° C. indicates a pressure equal to 34.3 atmospheres; hence 11.6° C. will represent many hundreds of atmospheres. (In fact it would represent more than 13,000 atmospheric pressures, an almost incredible estimate.) This calculation enters into Sachs' theory of the ascent of water in stems of trees, because of the high pressure with which it forces its way into fine tissues like the wood-cells: and which he further illustrates by reference to the use of wedges of wood for splitting granite, on the application of water so as to swell them. He accounts for the phenomenon by supposing that

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* Lectures on the Physiology of Plants, translated by Vines, 210.

† Theorie der Gärung. Abhand. der Akad. Wissensch. München, 13: 187. 1879.

the water has became compressed within the starch, and suggests that the water first entering the starch undergoes the highest rise of temperature, and therefore the greatest compression. Perhaps the phenomenon is parallel with that of gases entering spongy platinum or charcoal; and there may be partial condensation as well as compression of the imbibed water. Ganot states that the 'humus' is warmed in moist air by the imbibition of vapor, and that plants are thereby benefited. (Ganot's *Physics*, § 482.)

Neither Sachs, nor any other of the physiologists, so far as we know, has applied this discovery to the case of germination. The comparative freedom from water of ripe seeds has been usually explained as a protection from injury by exposure to extremes of heat or cold, but it seems to be also in a certain way a reserve of potential energy to be drawn on at proper time.

In a rude experiment we placed dry peas with water in a bottle, and beside it a 'controul' bottle of water at the same starting temperature. In about an hour the temperature of the first bottle exceeded that of the second; soon the difference reached 1° C., at which it remained for three days, when some of the peas were germinating. In a second experiment we used dry split-peas, devoid of seed-coat, without radicle or plumule, where there could be no germination. They absorbed the water quickly, but, as there was much loss of heat by radiation, they kept at a temperature only 1° C. higher than that of the control bottle; thus for fifteen hours, when they had become saturated, and the temperature fell to that of the other bottle. The difference of 1° C. will not appear insignificant if we reflect that Sachs made out a difference of only 1.5° C. between the temperature of germinating peas and that of the surrounding air. We may expect that the temperature after germination, though produced in a different way, is continuous in amount with the temperature before germination caused by the imbibition of water, and that there is no jolt or gap as to warmth in the transition from the dormant to the active condition of the embryo.

We have not attempted a quantitative estimate of the amount of heat produced. This might be effected by taking the weight of the seeds and the weight of the water, and finding how much ice would be necessary to keep them down to the temperature of the control bottle during the entire course of imbibition until germination begins. The significant part of the process is that when seeds are well protected from loss of heat, the imbibition-heat becomes cumulative, so as to reach a considerable amount and to be effective in starting the radicle of the young plant. This may help to elucidate the case cited by Uloth (1871) of the germination of seeds in ice. He found seeds of *Acer platanoides* and also of wheat, between blocks of ice in an ice-house, having started to grow and having pushed their roots several inches down into the fissureless ice. His suggestion was that heat may have radiated through the ice. It appears more probable that something like a lighted taper or burning straw may have melted enough of the ice to wet the seeds, that the heat of imbibition thus produced might melt more of the ice, and this cumulatingly react upon the seed, and so on acting and reacting, whilst the ice itself would present an obstacle against the waste of heat by dissipation in other directions. The fact of its not being an isolated case of a single seed is evidence to prove that there must have been some general cause at work.

PRINCETON UNIVERSITY,
March 22, 1898.

New Plants from Wyoming.—II.*

By Aven Nelson.

THLASPI GLAUCUM (A. Nelson).

Thlaspi alpestre glaucum A. Nelson, First Rep. Fl. Wyo. 84. 1896.

The perennial, basal part of stem freely branched, the several or many herbaceous stems simple, erect or ascending, 1–3 dm. high ; root leaves numerous, petioled, from oval to oblong or obovate, entire or obscurely repand-denticulate ; cauline leaves deltoid-auriculate or oblong, entire, 10–20 mm. long, smooth or even glaucous ; raceme dense in flower, much elongated in fruit (5–15 cm.) ; sepals greenish, thin, ovate ; petals white, spatulate, about 6 mm. long ; pods obovate, obtuse or emarginate ; pedicels divaricate, 10–14 mm. long.

In 1897 an abundance of material of this form was secured, an examination of which leads me to think that it is worthy of specific rank. Its habitat is sub-alpine in open parks or among open spruce timber. It is separated from *T. alpestre* by its uniformly larger size, numerous stems, numerous and larger stem leaves, longer pedicels and raceme (in fruit), longer, greenish sepals, etc.

Type specimen in Herb. University of Wyoming, no. 4176, Battle Lake, August 16, 1897. Prof. Henderson's no. 2893 from Kendrick, Idaho seems to be nearly the same.

MENTZELIA COMPACTA.

Annual, 2–2.5 dm. high, numerously and compactly branched ; stems whitish, pubescent, somewhat brittle ; leaves numerous, sessile, entire, obtuse, from broadly linear at base to almost oval at summit, generally ovate-oblong, 2–3 cm. long, rough-hirsute, more coarsely and sparsely so above ; flowers yellow, small, numerous in compact cymes at the ends of the branches, sessile, about 3 mm. broad ; calyx-lobes lanceolate-ovate, shorter than the corolla, petals obovate, about 4 mm. long; stamens 15, anthers small, sub-spherical; capsule linear-clavate, 10–13 mm. long, 10–12-seeded; seeds in one compact row, smooth, longitudinally groove-angled, in form from frustra of triangular prisms to rhomboidal cuboids, faces about 1 mm. long.

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* I am under obligations to Dr. Underwood for securing for me the comparison of these plants with specimens in the Columbia Herbarium ; and to Mr. P. A. Rydberg, for making such comparison. Mr. Rydberg's well-known familiarity with northwestern plants makes his examination of these particularly satisfactory.

Observed but once, possibly local or rare; Parkman, Sheridan county, Wyoming, July 22, 1896 ,no. 2454. Type specimen in Herb. University of Wyoming.

GENTIANA ELEGANS.

Annual, 2–3 dm. high, branched from the base, the 2–20 stems simple or nearly so, each stem or branch terminated by a single flower; leaves 3–6 pairs on each stem, appearing crowded toward the base in the many-stemmed specimens, mostly obtuse, the lower petioled, obovate to broadly spatulate, the upper sessile, oblong or narrower; calyx-lobes nearly equal and similar, equalling the tube in length, bearing in the sinus a fringe of short, obscurely glandular hairs: corolla 4–5 cm. long, deep blue with lighter patches or streaks downward, the lobes obovate-oblong, dentate around the summit, fimbriate on the sides: capsule stipitate; style nearly as long as the capsule proper, the stigma sub-orbicular, dentate.

This handsome species is common in the higher mountains of Wyoming at altitudes from 9000 to 10000 feet. Specimens of it have been distributed as "*Gentiana serrata* near var. *holopetala* Gray," as follows: no. 865, Union Pass, Wind River Mountains, August, 1894; nos. 1539, 1725, 1766 from the Medicine Bow Mountains, collections of 1895.

It differs strikingly from *G. serrata* Gunner (*G. detonsa* Rottb.) in its mode of branching, its broader obtuse leaves, in its dentate (not fimbriate) corolla-lobes, in the position of the fringe of hairs in the calyx, which is in the sinus, and not at the base of the lobes, and in its stipitate, styliferous capsule. *G. serrata,* moreover, is of the low, wet grounds of northern stations; *G. elegans* is met with only, so far as my observation goes, in the mountains at almost fixed altitudes. As the foregoing are essential characters it can hardly be united with the var. *holopetala* for again the narrower leaves, the character of the pistil and other points mentioned cut it out. *G. serrata holopeta!a* seems to be less branched, more slender and belongs to a more western range.

Type specimen in Herb. University of Wyoming, no. 1539, Cummins, July, 1895.

Gentiana elegans unicaulis.

Many of the characters of the species but smaller in every way, 1–2 dm. high, rarely if ever branched, the simple stems bearing 3–5 pairs of mostly obtuse leaves; the lower leaves small, obovate to oblong, the upper pairs longer and somewhat narrower; peduncles comparatively long; corolla-lobes obscurely dentate around the summit, mostly entire at the sides.

This form like the species is of the higher mountains, usually of more alpine stations. It often occurs in large, evenly planted beds, the plants nearly uniform in size.

Type specimens in Herb. University of Wyoming, no. 4173, Battle Lake, Carbon County, Wyo., Aug. 16, 1897.

Douglasia biflora.

Cespitose, the numerous suffrutescent branches crowned with a rosulate cluster of leaves, the dead clusters from previous years persisting and marking the gradually lengthening branches, only the current year's growth above the surface of the gradually elevated mound in which the stems are buried; leaves lanceolate-linear, blunt, 9–12 mm. long, glabrous or nearly so, margins obscurely denticulate, imbricate-clustered; peduncles pubescent, fascicled, 3–5 rising out of the terminal rosette of leaves, 1–3 cm. long; inflorescence a cyme with only the terminal and one lateral flower developed or sometimes only the terminal one, the terminal blossom almost sessile in the two-bracted involucre, pedicel of the lateral one 1 cm. or more in length; calyx campanulate, tube scarious, lobes foliaceous, lanceolate, equalling the tube; corolla-tube as long or longer than the calyx, the lobes nearly equalling the tube, obovate, truncate, emarginate or few-toothed; capsule turbinate-spherical.

Secured but once, about the summits of the Big Horn mountains near Dome Lake, July 18, 1896. Type specimen in Herb. University of Wyoming, no. 2450.

Phacelia deserta.

Stem single, erect from a stout perpendicular perennial root, 1–2 dm. high, densely leafy at base, sparsely so upward, the whole plant canescent with a short close pubescence, obscurely glandular; leaves petioled, narrowly oblong in outline, pinnate, the pinnae nearly oval and crenately toothed, 5–9 pairs which are nearly equal in size; stem branched at the summit giving a short dense paniculate inflorescence of scorpioid cymes; sepals equal, lanceolate-oblong; corolla bright blue, turbinate-campanulate, 7 mm. long, lobes equalling or surpassing the tube, lobes rounded, entire; the obliquely vertical lamellae broad and conspicuous, loosely united over the filament; anthers short-oblong; filaments and style conspicuously exserted; style cleft below the middle; ovary oval, pubescent, cells two-ovuled; ovules oblong; mature seeds not at hand.

Distinctively a desert plant, occupying the high, white, dry and barren bluffs known as the Green River shales. It develops early while the moisture from the spring snows make growth possible.

Type specimen in Herb. University of Wyoming, no. 3050, Green River, May 31, 1897.

PHLOX MULTIFLORA.

Suffrutescent as to the caespitose, much branched, prostrate base, the numerous herbaceous stems nearly erect, 6–10 cm. high, the annual branches simple, one-flowered; leaves broadly linear, glabrous, apiculate, 1–2 cm. long, opposite or fascicled; peduncles finely pubescent, 1–3 cm. long; calyx angled by the prominent midrib of the lobes, membranous in the sinus only, lobes linear-apiculate, equalling the tube; tube of the corolla exceeding the calyx, lobes obovate, entire, 1 cm. long; style equalling the calyx.

The affinities of this plant are with the *P. longifolia* group. It has been distributed under no. 182 from Laramie Hills, mostly as *P. longifolia* Nutt., but from which, I now think, it is wholly distinct. Its more caespitose growth, shorter broader leaves, simple branches, less membranous calyx and numerous flowers easily separate it. It is very abundant on the moister slopes and valleys of the Laramie Hills at 8000 to 9000 ft., flowering from late May till late June.

Type specimen in Herb. University of Wyoming, no. 3175, June 16, 1897.

GILIA ATTENUATA (Gray).

Gilia aggregata, var. *attenuata* Gray, Syn. Fl. **2**^{1}: 145. 1886.

It seems to me that only lack of sufficient material can justify leaving this as a variety. The points in which this differs from *G. aggregata* need to be emphasized. They are, as pointed out by Dr. Gray, the considerably longer corolla-tube (about 3.5 cm. as against about 2.5 cm.), the long, gradually-acuminated corolla-lobes, the filiformly-attenuated calyx-lobes, the constant inclusion of both style and stamens (the position of the stigma and of the anthers varies between 5 mm. and 10 mm. below the throat of the tube), and the white corolla (tube somewhat marked with pink).

It may be added that the *G. attenuata* is hoary or villous-pubescent, especially on the branchlets and calyx; the inflorescence much denser; calyx more glandular and the basal leaves green and glabrate. It seems probable that it will be found to belong to considerably higher altitudes than *G. aggregata*.

Excellent specimens were secured at Battle Lake, Carbon Co., at an altitude of about 10000 feet, Aug. 16, 1897, no. 4189.

PENTSTEMON COLLINUS.

Cespitose, the rootstocks much branched and closely matted; stems numerous, unbranched, erect, often wavy rather than strict, 2–3 dm. high, puberulent their whole length, glandular upward; root leaves numerous, entire, clustered on the crowns of the rootstocks, a dull or dead green, glabrous but scarcely smooth, midrib prominent on the lower face, petioles slender, about equalling the blade, blade elliptic-oblong, acute at both ends, 2–3 cm. long; stem leaves sessile or tapering into a marginal petiole, narrow-oblong or spatulate, 2–4 cm. long; upper leaves shorter, lanceolate-linear, passing into the shorter lanceolate bracts; thyrsus strict, interrupted, 5–9 cm. long, the whole inflorescence minutely glandular-puberulent; peduncles 3–5-flowered, the flowers crowded; sepals broadly lanceolate, scarious margined, loosely spreading, one-third as long as the corolla; corolla deep blue, slender-tubular, but slightly inflated upwards, the lobes short, spreading, sparsely hairy in the throat; sterile filament comose on the flattened apex; anthers dehiscent through the junction of the two cells, not explanate.

Its general aspect and floral characters suggest *P. humilus* Nutt. but it may be distinguished by its more caespitose habit, its more compact root system, its rosulate, pointed root leaves, its smaller, more tubular corolla with shorter lobes, the erect, wavy, puberulent stems and more rigid and paler leaves.

Its habitat seems to be the dry, gravelly hilltops in the foothills. Type specimen in Herb. University of Wyoming, no. 2960, Evanston, May 28, 1897.

PENTSTEMON RADICOSUS.

Cespitose, the short rootstocks producing an inordinate number or coarsely fibrous roots which form an almost unbreakable tufted mat; stems numerous, slender, fascicled, strict and erect, forming a dense bunch which crowns the compact, tufted root system, 2–3 dm. high; stems and leaves puberulent, obscurely glandular upward including the inflorescence; root leaves minute, oblanceolate, or none; stem leaves numerous, oblong-linear, very short-petioled or sessile by a narrowed base, 2–4 cm. long, narrower upward and passing into the linear bracts; inflorescence a compact thyrsus of peduncled cymes, 4–8 cm. long; peduncles 8–12 mm. long, about 3-flowered, pedicels very short; sepals broadly lanceolate, somewhat scarious, about one-third the length of the corolla, tips spreading; corolla tubular, dark blue with a lighter streak down the lower side of the tube, 14–18 mm. long, upper part of the tube slightly inflated, bilabiate, the lower lip longer, very sparsely white bearded, lobes entire, rounded, 3–4 mm. long; sterile filament included, straight, slightly flattened toward the apex, the short yellow beard straight, stiff, of nearly uniform length, at right angles to the filament, dense at apex, more sparse downward past the middle; anthers purple, dehiscent through the junction of the cells but not explanate.

A well marked species easily recognized by its compactly bunched stems, its striking root system and its very numerous, small, uniform leaves. Habitat, gravelly hillsides.

Type specimens in Herb. University of Wyoming, no. 2962, Evanston, May 28, 1897; no. 3089, Point of Rocks, June 1, 1897.

PENTSTEMON ARENICOLA.

Perennial from long vertical branched woody rootstocks, from the crown of each branch one to several simple stems, 2–3 dm. high; entire plant glabrous and stem leaves somewhat glaucous; lower leaves petioled, oblanceolate to broadly spatulate; middle stem leaves spatulate, tapering into a margined petiole, 4–5 cm. long; upper stem leaves sessile by a broad base, from narrowly oblong to lanceolate, abruptly acute or apiculate, 3–4 cm. long; inflorescence short, spiciform, leafy below, the upper bracts short, ovate-lanceolate; sepals broadly laneeolate, slightly scarious, one-fourth the length of the corolla-tube; corolla tubular or but slightly inflated upwards, blue, 12–15 mm. long, its lobes oval, spreading, 3 mm. long, naked in the throat; sterile filament equalling the tube, its hooked flattened apex comose, more sparsely hairy down one side for half its length; anthers dehiscent through the junction of the two cells but the cells hardly confluent, not explanate.

This plant has the habit of *P. coeruleus* Nutt., but is readily distinguished by its broader, shorter leaves; its shorter inflorescence and smaller flowers; its broader, shorter and slightly scarious sepals, etc.

Abundant in the sand dunes in the hill region of the Red Desert, near Point of Rocks. Collected June 1, 1897, at which time it was nearly out of blossom. Type specimen in the Herb. University of Wyoming, no. 3090.

PENTSTEMON RYDBERGII.

Perennial from horizontal rootstocks which give rise at somewhat regular intervals to vertical branches; from the crowns of these spring long slender floriferous stems or very short leafy branches; glabrous throughout, 3–5 dm. high; radical leaves and those on the sterile branches oblong, obtuse, on slender petioles as long as the blade or longer; cauline leaves few, sessile by a broad base, narrowly oblong; the lowest pair of bracts leaf-like, broadly linear; the two or more verticils of the interrupted spike many-flowered, the lower one usually distant; corollas 10–14 mm. long, light blue; sepals scarious, somewhat lacerate-margined.

This beautiful form has enough points in common with *P. confertus* Dougl. to suggest that species which is probably the nearest ally. It was met with in abundance in an aspen grove in a draw in the Laramie Hills, July 1, 1897. Type specimen in Herb. University of Wyoming, no. 3214. I take pleasure in naming this for Mr. P. A. Rydberg, whose generous assistance I have acknowledged on a previous page.

WULFENIA WYOMINGENSIS.

Perennial from a short rootstock, bearing numerous fascicled roots; stems 1–3 from each rootstock, puberulent or softly pubescent, 1–2.5 dm. high; radical leaves petioled, from broadly ovate to oblong, crenate-dentate, rounded or subcordate at base, mostly obtuse at apex, very variable in size, obscurely puberulent; cauline leaves sessile, small, diminishing upward, broadly ovate, mostly acute; bracts broadly lanceolate, narrower toward the apex of the spike, pilose-pubescent; calyx anteriorly cleft to the base, posteriorly into two or three lobes to about the middle, the lobes either entire or (if only two) with two tooth-like lobes; corolla wanting; stamens conspicuous, filaments twice the length of the calyx, anthers large, the cells slightly divergent below; style equalling the stamens; stigma small, capitate; ovary pilose-pubescent; capsule emarginate, large, turgid, puberulent, protruding from the cleft side of the calyx.

Common in the Laramie Hills at 8000 to 9000 feet where it develops early. It seeks the loose, rich soil of the valleys and slopes among the sage-brush. It has the habit of *W. rubra* (Dougl.) Greene and is easily mistaken for that species. However, the peculiarity of its calyx alone will easily separate it. Distributed by me under the name *Synthyris rubra* Dougl. as nos. 29 and 1242. Type specimens in Herb. University of Wyoming.

WULFENIA GYMNOCARPA.

Perennial from a short rootstock bearing numerous fascicled roots; stems simple, 1–3 from each rootstock, curved ascending, puberulent or soft-pubescent, 1–3 dm. long; radical leaves numerous, petioled, mostly ovate-oblong, rounded at base or rarely subcordate, from coarsely to obscurely crenate-denticulate, glabrate or puberulent; cauline leaves sessile, small, from ovate to oblong-lanceolate, smaller and narrower upward where they pass into the bracts; spike short and crowded, 3–8 cm. long, pilose-pubescent, bracts from broadly lanceolate at base of spike to linear at summit; calyx reduced to three, or more usually to two sepals, these on the posterior side, the anterior face of the pistil being naked; sepals distinct to the base or occasionally united one-third of their length, linear-lanceolate, soft-pubescent; corolla wanting; stamens but little longer than the sepals, apparently often unequal, anthers small, the cells not divaricate: ovary pubescent, style long, equalling the stamens but with the development of the capsule carried out beyond them; capsule orbicular, much flattened at maturity, equalling or longer than the style, naked but for the slender bract and sepals closely approximated on its posterior angle.

Like the preceding, this has the general habit of *W. rubra.* It is with some hesitation that I add two more species in which the corolla is wanting, to the genus *Wulfenia.* But these two certainly lend strength to Dr. Greene's contention * that the number of calyx-lobes cannot in this group be used as a diagnostic character by which to separate *Synthyris* from *Wulfenia.*

Type specimen in Herb. University of Wyoming, no. 2959, from Evanston, May 29, 1897.

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* Erythea, May, 1894.

SCUTELLARIA VIRGULATA.

Perennial from slender oblique rootstocks, the nodes of which are often marked by scales; stems puberulent, simple, one or more from the crown of the rootstock, slender, strict or sometimes curved, leafy throughout, 2–3 dm. high; leaves entire, nervose, bright green, puberulent under a lens, nearly sessile; lower stem leaves small or rarely wanting, obovate to oblong, 1–2 cm. long, much shorter than the internode; middle stem leaves oval to oblong, obtuse, about 3 cm. long, equalling the internode; upper stem leaves from oblong to lance-linear, longer than the internodes, appearing crowded, obscurely glandular; flowers blue, borne singly in the axils of the upper pairs of leaves, resinous-puberulent; pedicels about one-half as long as the calyx; calyx green even as to the crest; corolla-tube gradually dilated upward, about 2 cm. long, glabrous in the throat; nutlets minutely tuberculate.

Closely allied to *S. Brittoni* Porter but with slenderer rootstocks, longer, slenderer, more virgate stems and fewer flowers. In *S. Brittoni* the internodes are uniformly shorter than the leaves, in this only the upper leaves exceed the internodes.

In loose soil among the stones on the partly wooded summits of the Laramie Hills at about 9000 feet. Type specimen in the Herb. University of Wyoming, no. 3218, Green Top, June 28, 1897.

RUMEX TUBEROSUS.

Perennial by a horizontal woody rootstock on the under side of which are borne large fascicled, oblong-elliptic tubers; glabrous throughout; stem stout, nearly erect, conspicuously grooved, 2–4 dm. high; leaves large, moderately thick, somewhat crisped on the edges, crowded at the base, smaller and more distant upwards, all petioled, lower oblanceolate-oblong; 10–15 cm. long, 3–5 cm. wide, upper lanceolate; ocreae large and thin; racemes erect; bracts few, leaf-like, lanceolate, seemingly deciduous, the inflorescence at length naked and interrupted; calyx red, conspicuously winged at maturity; pedicels filiform, as long or longer than the wings; wings cordate, 10–13 mm. long, no callosities, deep red, lighter with age; style branches divergent; achene 10 mm. long, smooth with margined angles.

This species seems most closely allied to *R. venosus* Pursh which it simulates in habit. It is, however, a larger plant while the wings of the fruit are smaller. It is strikingly separated from this, and all other species known to the writer by its large tuberous rootstocks. Its habitat also is distinctive, for it was observed only in the most pronounced alkali soils—in the white, friable, ash-like soil, containing 5 to 15 per cent. of salts, found on some portions of the Bitter Creek flats in the Red Desert.

Type specimen in Herb. University of Wyoming, no. 3114, Bitter Creek, June 3, 1897.

A Correction.

ATRIPLEX EREMICOLA. (*Atriplex fruticulosa* G. E. Osterhout, Bull. Torr. Bot. Club, **25**: 207 Ap. 1898. Not *A. fruticulosa* Jepson, Pittonia, **2**: 306, 20 S. 1892.) Since the specific name *fruticulosa* is antedated in this genus, I substitute the above name for the one which I first published.

GEORGE E. OSTERHOUT.

NEW WINDSOR, COLORADO,
April 19, 1898.

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OF THE

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JUNE 1898

The Genus Syntherisma in North America.

By George V. Nash.

The genus *Panicum*, of which the plants under consideration have been and are regarded a section by some authors, is, as now generally constituted, far too comprehensive and extended, embracing too many and too diverse groups, thus making the classification of the forms arbitrary and unsatisfactory. This view has not always obtained, however. Among some of the earlier botanists and students of grasses these sectional groups were recognized as genera and the consequent result was much more logical and consistent than that reached by some of the more recent students of this family. This treatment by segregation into smaller and natural groups in our opinion is much to be preferred, and this view and the generic validity of the genus *Syntherisma* were briefly indicated by the author in this Journal a few years ago.* A more extended study, the results of which are given below, has but confirmed us in the opinion then expressed.

Scopoli † appears to have been the first to confer upon these forms the dignity of generic rank under the name of *Digitaria*. It is much to be regretted that this name, so descriptive of the plants, should not be tenable, but Heister had previously applied it to another group, thus preventing its use in this connection. The name conferred by Scopoli was also used by Haller,‡ but he

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* 22: 420. 1895.

† Fl. Carn. Ed. 2, 1: 52. 1772.

‡ Hist. Stirp. 2: 244. 1768.

[Issued 8 June 1898.]

attributed it erroneously to Heister and Adanson, the genus of that name in Adanson's work[*] undoubtedly referring to the *Tripsacum* of Linnaeus; Michaux[†] also adopted it, but by some mistake cited its author as Haller; Persoon[‡] followed in its use, but accredited the authorship to Richard; later still, Beauvois[§] maintained the genus under the same name; Pursh[||] took the same view of the matter, but made the same mistake as his predecessor, Michaux, and cited the author as Haller; and the acute observer Elliott,[¶] who did most excellent work among the grasses, came to the same conclusion. But, as stated above, Heister's previous application of the name debars its use again, although so generally adopted during the forty or fifty years subsequent to its publication by Scopoli. Walter's name, the one here adopted, seems to be the earliest available.

Trinius considered the genus a section of *Panicum*, using the name *Digitaria*, and this disposition of the group has been quite generally followed for a number of years.

But this manner of treating the matter hardly seems consistent, in view of the disposition of other groups whose grounds for separation from *Panicum* are no more valid than are those which can be pointed out for *Syntherisma*. *Paspalum*, *Anthaenantia*, *Eriochloa*, *Isachne*, *Ichnanthus* and *Tricholaena* are no more worthy of generic distinction than is this group. The characters separating them are no more marked, and in some cases not so much so. *Paspalum* in its inflorescence is readily distinguished from true *Panicum*, but the technical and arbitrary character of three scales to the spikelet is not to be relied on. For in *Paspalum bifidum* (Bertol.) Nash, a large proportion of the spikelets have four scales, thus making it technically a *Panicum*, so far as these individual spikelets are concerned. *Dimorphostachys* of Fournier is a *Paspalum* in everything but the spikelet, which has four scales.

In *Syntherisma* a somewhat similar condition of things exists. We have the inflorescence of *Paspalum* and the arrangement of the spikelets is as in that genus, but the technical character of three or four scales is utterly unreliable. In some species there are three, in others four scales, and it often happens, especially in one or two species, that spikelets of both three and four scales occur indiscriminately in the same raceme, as mentioned above in connection with *Paspalum bifidum.*

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[*] Fam. Pl. 2: 38. 1763.

[†] Fl. Bor. Am. 1: 45. 1803.

[‡] Syn. Pl. 1: 84. 1805.

[§] Agrost. 50. 1812.

[||] Fl. Am. Sept. 1: 69. 1814.

[¶] Bot. S. C. and Ga. 1: 131. 1817.

So it will be readily seen that *Paspalum* is as closely related to *Panicum*, through *Paspalum bifidum* and *Dimorphostachys* as is *Syntherisma*, and if one is to be separated, to be consistent the other must be also. Our own view is that *Syntherisma* is more nearly related to *Paspalum* than to *Panicum*, and if its union with either genus were desirable it would certainly be with the former and not with the latter.

All the other genera above enumerated are in some forms very close to *Panicum* or *Paspalum;* for *Isachne* is only distinguished from *Panicum* by having the first as well as the second flower perfect; *Ichnanthus* has a spikelet similar to that in some forms of *Panicum*, but the fourth scale is pitted or winged at the base, sometimes rather obscurely so; *Tricholaena* differs from *Panicum* and *Eriochloa* from *Paspalum* in characters which are no more prominent or important than those distinguishing *Syntherisma;* yet all these genera are considered distinct, while such as *Trichachne*, *Brachiaria*, *Echinochloa* (certainly as close to *Oplismenus* as is *Syntherisma* to *Panicum*), *Hymenachne* and *Ptychophyllum* are relegated to that convenient repository of many modern authors, *Panicum*, although certainly as worthy of specific rank as are those previously mentioned. Would not then consistency demand that all be united with *Panicum*, or if one or more be separated, then all? The answer can hardly be other than in the affirmative.

There is one grass in this country and adjacent Mexico which has characters that ally it to the genus we have under consideration, and would at first sight make it appear intermediate between this and *Trichachne.* Reference is made to what has been called *Panicum tenerrimum* of Kunth. The spikelets do resemble somewhat those of *Syntherisma*, but the habit of the plant and the short appressed branches of the inflorescence make evident its closer relationship to the *Panicum lacnanthum* of Torrey.

The results here attained have been reached after an examination and study of the material in my own herbarium, and in the herbaria of the New York Botanical Garden, Columbia University, and the Division of Agrostology at Washington, D. C., the latter being kindly sent to me for this purpose by Professor Scribner, to whom I desire to express my thanks for the courtesy.

Descriptions of the genus and the species and their distribution follow:

SYNTHERISMA Walt. Fl. Car. 76. 1788.

[DIGITARIA Scop. Fl. Carn. Ed. 2, **1**: 52. 1772. Not Heist. 1763.]

Usually annual, sometimes perennial, commonly tufted grasses, with simple or branched culms, flat leaves, and an inflorescence composed of one-sided racemes which are variously arranged, singly and alternate, in more or less approximate pairs, in whorls, digitate, or in various combinations of these, the rachis 3-angled, the lateral angles often broadly winged, making the rachis appear flat. Spikelets usually in pairs, sometimes in 3's or 4's, from elliptic to lanceolate, acute or acuminate, alternately arranged in two rows. Scales 3 or 4, the outer 2 or 3 membranous; first scale wanting or minute; second usually much larger than the first, rarely very small, sometimes as long as the third; third scale about as long as the spikelet; fourth scale chartaceous or indurated at maturity, enclosing a palet of equal length and similar texture.

The genus consists of some 25 or 30 species, widely distributed in warm or tropical countries. Two or three of the species are widely scattered as weeds, being almost cosmopolitan.

Key to the Species.

Rachis of the racemes with the angles naked, not winged; first scale wanting or sometimes present as an inconspicuous rudiment.

Second and third scales pubescent with appressed glandular tipped hairs; culms simple or sparingly branched at the base; nodes 5 or less.

Racemes usually short, 2–10 cm. long; spikelets less than 2 mm. long. 1. *S. filiformis.*

Racemes usually exceeding 10 cm. in length, rarely shorter; spikelets 2.25 mm. or more long.

Pubescence on the sheaths spreading; racemes commonly more than 5. 2. *S. villosa.*

Pubescence on the sheaths appressed or nearly so; racemes commonly less than 4. 3. *S. leucocoma.*

Second and third scales glabrous.

Hairs on the sheaths appressed or nearly so; nodes 5 or less.

Second scale one-half or less as long as the spikelet, rounded or truncate at the apex. 4. *S. gracillima.*

Second scale more than one-half as long as the spikelet, sparingly pilose at the acute apex. 5. *S. Bakeri.*

Hairs on the sheaths widely spreading; nodes numerous. 6. *S. Simpsoni.*

Rachis of the racemes with the lateral angles broadly winged, thus making it appear flat; first scale usually present, generally wanting in Nos. 7 and 8.

Pedicels terete or sometimes obscurely angled, sparingly if at all hispidulous.

Sheaths and leaves strongly papillose-hirsute; rachis of the racemes .8 mm. or less wide; second scale one-half or less as long as the spikelet. 7. *S. serotina.*

Sheaths and leaves glabrous; rachis of the racemes 1 mm. or more wide; second scale nearly as long as the spikelet. 8. *S. linearis.*

Pedicels sharply 3-angled, the angles strongly hispidulous.

Sheaths strongly papillose-hirsute; racemes commonly more than 3.

Racemes very slender, the rachis usually less than .5 mm. wide; spikelets one-fifth as wide as long, acuminate; fourth scale greenish when mature. 9. *S. setosa.*

Racemes stouter, the rachis usually exceeding .7 mm. wide; spikelets one-quarter or more as wide as long, acute; fourth scale yellowish white when mature.

Spikelets usually less than 3 mm. long, the second scale one-half or less as long as the spikelet, the third scale with the first and second nerves on each side hispid above the middle. 10. *S. sanguinalis.*

Spikelets commonly more than 3 mm. long, the second scale more than one-half as long as the spikelet, the third scale with the nerves smooth. 11. *S. fimbriata.*

Sheaths glabrous or nearly so; spikelets about 4 mm. long; racemes 2. 12. *S. barbata.*

1. SYNTHERISMA FILIFORMIS (L.) Nash, Bull. Torr. Bot. Club. 22: 420. 1895.

Panicum filiforme L. Sp. Pl. 57. 1753.

Culms 1.5–7 dm. tall, slender, erect, simple or somewhat branched, smooth and glabrous, more or less flattened; nodes 2–4; culm leaves 2–4; sheaths flattened, keeled, at least toward the apex, papillose-hirsute, or the uppermost one glabrous, at least above; ligule a scarious irregularly toothed ring 1–2 mm. long;

blades 3–20 cm. long, 1–4 mm. wide, flat, erect, usually glabrous on the lower surface, excepting sometimes in the lowermost leaves, the upper surface, as well as the margins, rough, papillose-hirsute at the base, and sometimes sparingly so a little further up: panicle long-exserted, the axis 1–3 cm. long, smooth and glabrous; racemes 2–5, 2–10 cm. long, erect or ascending, alternate, the rachis 3-angled, the angles hispidulous and not winged: spikelets about 1.8 mm. long, .75 mm. wide, elliptic, acute, on hispidulous 3-angled pedicels, in pairs; outer empty scales white or purplish, the first scale wanting, the second three-fourths to seven-eighths as long as the spikelet, 3-nerved, the margins and the internerves pubescent with long appressed glandular tipped hairs, the third scale slightly shorter than the fourth, 7-nerved, the margins and the first and second internerves on each side pubescent with long appressed glandular tipped hairs, the fourth scale deep chestnut brown at maturity, striate, obtusely apiculate; palet of equal length and similar texture.

Dry sandy soil, Massachusetts to Michigan, south to Delaware, North Carolina and the Indian Territory.

2. SYNTHERISMA VILLOSA Walt. Fl. Car. 77. 1788.

Culms densely tufted, 6–14 dm. tall, slender, erect, simple or somewhat branched, smooth or glabrous; nodes 3–5: culm leaves 3–5; sheaths flattened, keeled, at least toward the apex, the lower densely papillose-hirsute, the uppermost one sparingly so or glabrous; ligule an irregularly toothed scarious ring 1–2 mm. long: blades .7–2.5 dm. long, 3–6 mm. wide, flat, erect or nearly so, smooth beneath, rough above, the lower more or less papillose-hirsute, particularly on the upper surface near the base, the upper leaves glabrous: panicle long-exserted, the axis 3–9 cm. long, usually exceeding 5 cm., smooth and glabrous; racemes 2–8, commonly more than 5, 4–20 cm. long, generally 12–15 cm., erect or ascending, rarely spreading, alternate, the rachis triangular, the angles hispidulous and not winged: spikelets 2.5 mm. long, about .8 mm. wide, elliptic, acute, on 3-angled sparingly hispidulous pedicels, usually in 3's, in pairs toward the apex of the racemes; first scale wanting, the second and third scales pubescent with long appressed glandular tipped hairs, the second scale 3-nerved, a little shorter than the third, the pubescence on the margins and internerves, the third scale slightly shorter than the fourth, 7-nerved, the pubescence on the margins and on the second and usually also the first internerves on each side, the fourth scale deep chestnut brown when mature, elliptic to elliptic-lanceolate, striate, apiculate; palet of equal length and similar texture.

Sandy soil along the coast from Georgia and Florida to Texas; also in the Indian Territory and Illinois, and probably south along the Mississippi River.

The much longer and more numerous racemes and the larger and comparatively narrower spikelets afford characters sufficiently marked, it is believed, to warrant its maintenance as specifically distinct from *S. filiformis*, to which in some of its forms it is closely related.

3. SYNTHERISMA LEUCOCOMA sp. nov.

Culms 1 meter or less tall, rather slender, erect, smooth and glabrous; nodes 1 or 2: culm leaves about 2; sheaths somewhat compressed, keeled, at least toward the apex, coarsely striate, the lower one densely hirsute with nearly appressed hairs, the upper one much elongated, similarly but sparingly pubescent toward the base only; ligule a membranous ring 2–3 mm. long, externally somewhat pubescent; blades erect, flat, often involute when dry, glabrous on the lower surface, on the upper surface rough, as are the margins, and sparingly pubescent at the base, 3 mm. or less broad, those on the culm from 1.5–2.5 dm. long, those on the innovations 1–4 dm. long, frequently narrower and involute: panicle exserted, the axis 4–6 cm. long, smooth, pilose at the base; racemes 2–4, 2–2.5 dm. long, erect or nearly so, alternate, the rachis 3-angled, the angles hispidulous and not winged, the base sometimes branched, the branches 1.5 cm. or less long: spikelets 2.25–2.5 mm. long, .8 mm. wide, elliptic, acute, on hispidulous 3-angled pedicels, usually in 3's, in pairs toward the summit of the racemes; outer empty scales white, the first wanting, the second about as long as or a trifle shorter than the flowering scale, 3-nerved, the margins and internerves pubescent with very long erect glandular tipped hairs, the third scale a little longer than the fourth, 7-nerved, the margins and the first and second internerves on each side pubescent with very long appressed grandular tipped hairs, the fourth scale brown at maturity, striate, apiculate; palet of equal length and similar texture.

High pine land, Florida. Collected apparently only by the writer at Lake Ella, Lake Co., July 3, 1894, no. 1155.

4. SYNTHERISMA GRACILLIMA (Scribn.).

Panicum gracillimum Scribn. Bull. Torr. Bot. Club, **23**: 146. 1896.

Culms tufted, slender, 6–8 dm. tall, smooth and glabrous, the innovations about one-half as long; node 1, deep brown, 1 dm.

or less from the base; culm leaves 2; sheaths loosely embracing the culm, the lower, as well as those on the innovations, somewhat hirsute with ascending-appressed hairs, the upper sheath 4 dm. or less long, smooth and glabrous, or sparingly hirsute at the base; ligule a membranous ring about 2 mm. long; blades 2 mm. or less wide, smooth on the lower surface, rough on the upper and more or less hairy at the very base, those on the innovations 3–4 dm. long, the upper culm leaf 1.5 dm. or less long; panicle long-exserted, the axis 3–6 cm. long; racemes 2, or rarely 3, about 3 dm. long, erect, the rachis 3-angled, the angles hispidulous and not winged; spikelets slightly exceeding 2 mm. in length, about .8 mm. broad, elliptic, acute, in 2's–4's, usually in 3's, irregularly scattered, the hispidulous 3-angled pedicels of varying length united at the base, the short united portion minutely pubescent; scales glabrous, the first wanting, the second and third white, membranous, the former one-half or less as long as the spikelet, usually one-quarter as long, 3-nerved, rounded or truncate at the apex, the latter 5-nerved, acute, slightly shorter than the spikelet, the fourth scale indurated and of a deep seal brown when mature, conspicuously longitudinally striate, obtusely angled on the back, the apex apiculate; palet of equal length and similar texture; grain white, elliptic-oblong, about 1.5 mm. long.

High pine land, Florida. Apparently collected only by the writer at Eustis, Lake Co., July 6, 1894, no. 1192.

5. SYNTHERISMA BAKERI sp. nov.

Culms tufted, 1 metre or less tall, simple, erect, slender, the innovations about one-half as long; node 1; culm leaf 1; sheaths somewhat compressed, usually longer than the internodes, densely hirsute with ascending hairs, the upper sheath much elongated and glabrous toward the summit, the sheaths of the innovations shorter and crowded; ligule a scarious ring about 1 mm. long; blades 2 mm. or less wide, involute when dry, smooth on both surfaces, glabrous beneath, also above excepting at the very base where they are densely pubescent with long hairs, those on the innovations 2–4 dm. long, on the culms 1–2.5 dm. in length; panicle long exserted, the axis 4–7 cm. long, angled, the angles hispidulous; racemes usually 3, sometimes 2, commonly somewhat branched at the base, erect or nearly so, densely long-pilose at the base, 14–22 cm. long, the rachis 3-angled, the angles not winged but strongly hispidulous: spikelets about 2.25 mm. long, .8 mm. wide, elliptic, usually in 3's, on successively longer pedicels which are 3-angled, the angles strongly hispidulous; first scale wanting, the second about four-fifths as long as the spikelet, acute or acutish, sparsely pilose at the apex, otherwise glabrous, 3-nerved, the third scale a little shorter than the fourth, 7-nerved, glabrous, the fourth scale deep chestnut brown when mature, elliptic, obtusely apiculate, rather faintly striate, enclosing a palet of equal length and similar texture.

Collected at Grasmere, Florida, by Mr. C. H. Baker, no. 47. It is closely related to *S. gracillima*, but its more densely pubescent sheaths, the pilosity at the base of the racemes, the much longer and acute second scale with its pubescent apex, and the fainter striation of the fourth scale seem to warrant the above disposition of it.

6. SYNTHERISMA SIMPSONI (Vasey).

Panicum sanguinale, var. *Simpsoni* Vasey, Contr. U. S. Nat. Herb. **3**: 25. 1892.

Culms 8–12 dm. long, more or less compressed, smooth and glabrous, branching, at first erect, finally prostrate at the base and rooting at the lower nodes; nodes numerous, deep purplish black, pilose: culm leaves numerous; sheaths loosely embracing the culm, keeled, of varying length, from shorter to longer than the internodes, copiously papillose-hirsute, the hairs widely-spreading; ligule a membranous ring 2–3 mm. long, purple at the base; blades 7–30 cm. long, 5 mm. or less wide, flat, ascending, rough on the margins, papillose-hirsute on both surfaces: panicle long-exserted, the axis 4–6 cm. long, smooth; racemes 6–8, 10–13 cm. long, erect or ascending, scattered, or sometimes approximately in pairs, the rachis 3-angled, the angles hispidulous and not winged: spikelets a little exceeding 3 mm. in length, about 1 mm. wide, elliptic-lanceolate, acute, on hispidulous 3-angled pedicels, in pairs, one short-, the other long-pedicelled, the tip of the latter usually about reaching the base of the next pair of spikelets; scales glabrous, the first one wanting or sometimes present as a minute rudiment, the second and third scales about equal in length, the former 5-, the latter 7-nerved, the fourth scale a little shorter than the third, elliptic, acute, yellowish white, finely striate; palet of equal length and similar texture; stamens red-purple, about 1.8 mm. long.

Moist saline soil, Florida. This is more nearly related to *S. filiformis* than to *S. sanguinalis*, the unwinged rachis at once excluding it from relationship with the latter. It is one of the most marked forms of this genus and certainly worthy of specific rank, to which distinction I take pleasure in raising it, thus concurring with Mr. Simpson, of Manatee, Fla., who has long maintained its right to recognition as a species, and in whose honor the varietal name was given.

Mr. Simpson, who first brought this grass to the attention of botanists, informs me that it was originally discovered by Mr. James J. Crowley, about 1886, at Crane's Bayou, on Long Key, situated southwest of Sarasota Bay. It made a very dense and rank growth from 3½–4 feet tall, being much more vigorous along low ground, thus indicating its preference for a moist saline soil. Hay made at the above locality was taken to the vicinity of Manatee, the seed thus becoming scattered and introducing the plant into that region. It thrived in a ditch for a short time, but has now disappeared. Prior to its disappearance Mr. Simpson transplanted a turf into his own yard, which has now spread to a considerable extent. It was from this transplanted material that the specimens were made from which the above description is drawn. Mr. Simpson also informs me that he has been to Long Key three times since the original discovery of this grass, but has failed to detect it there. Mr. Crowley knew of its occurrence nowhere else but at this one place on Long Key, and from Mr. Simpson's experience in searching for it, it would appear that the only known locality for it at present is in Mr. Simpson's garden, near Manatee. It is to be hoped that it will turn up from other localities, and this will probably be the case when that little known region is more thoroughly explored and its yet hidden botanical treasures brought to view.

Dr. Vasey,* in addition to the locality above given, indicates the occurrence of this grass also in Mississippi, and cites S. M. Tracy as the collector. All the specimens so named I have seen from that state collected by Mr. Tracy belong to *S. fimbriata*. Its occurrence, therefore, outside of Florida remains to be verified.

7. SYNTHERISMA SEROTINA Walt. Fl. Car. 76. 1788.

Digitaria serotina Michx. Fl. Bor. Am. **1**: 46. 1803.

Panicum serotinum Trin. Gram. Panic. 166. 1826.

Culms 2–5 dm. long, tufted, at first simple and erect, at length much branched and prostrate and rooting at the lower nodes, smooth and glabrous; nodes 5–many: culm leaves 5–many; sheaths a little flattened, usually shorter than the internodes, the lower ones densely, the upper and longer one sparingly, papillose-hirsute with spreading hairs: ligule a scarious irregularly toothed ring about 2 mm. long; blades 1.5–10 cm. long, usually less than 5 cm., 3–10 mm. wide, flat, lanceolate, more or less ascending, 7–9 nerved, rough on the margins, pubescent on both surfaces with spreading hairs, the pubescence of two kinds, the one short and soft, the other longer, rigid and arising from papillae: panicle exserted, the axis 1–2 cm. long, smooth and glabrous; racemes 2–6, usually 3 or 4, 2.5–10 cm. long, commonly less than 6 cm., ascending or nearly erect, alternate, or sometimes approximate in pairs, the rachis 3-angled, the lateral angles broadly winged, the wings about .3 mm. wide, rough on the margins: spikelets about 1.5 mm. long, about .6 mm. wide, elliptic, acute, on pedicels which are terete or nearly so and glabrous, usually in pairs, sometimes in 3's; outer empty scales pubescent with long appressed hairs, the first scale wanting, the second about one-third as long as the spikelet, 3-nerved, the pubescence on the margins and internerves, the third scale a little shorter than the flowering scale, the pubescence on the margins and the second internerves on each side, the fourth scale white, ovate-lanceolate, acute; palet of equal length and similar texture.

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* Contr. U. S. Nat. Herb. **3**: 25. 1892.

Low open grounds, Delaware to Florida, west to Mississippi.

8. SYNTHERISMA LINEARIS (Krock.) Nash, Bull. Torr. Bot. Club, **22**: 420. 1895.

Panicum lineare Krock. Fl. Sil. **1**: 95. 1787.

Digitaria humifusa Pers. Syn. **1**: 85. 1805.

Syntherisma glabra Schrad. Fl. Germ. **1**: 163. 1806.

Paspalum ambiguum DC. Fl. Gal. 123. 1806.

Panicum glabrum Gaud. Agrost. **1**: 22. 1811.

Culms 2–5 dm. tall, slender, at length branched at the base, finally prostrate and forming large tufts, smooth and glabrous; nodes 2–4: culm leaves 2–4; sheaths flattened, smooth, glabrous, at least all but the lowermost ones; ligule a scarious ring about 2 mm. long: blades 1.5–13 cm. long, usually 3–5 cm., 2.5–6 mm. wide, flat, erect or nearly so, smooth and glabrous on both surfaces or nearly so: panicle finally long-exserted, the axis 1–3 cm. long, smooth and glabrous; racemes 2–5, more frequently 2 or 3, very rarely 5, 2–8 cm. long, usually 3–6 cm., finally widely spreading, alternate, or approximate in pairs, the rachis triangular, the lateral angles broadly winged, the wings about .5 mm. wide and hispidulous on the margins : spikelets slightly exceeding 2 mm. long, about 1 mm. wide, elliptic, acutish, on 3-angled pedicels which are sparingly or not at all hispid at the apex, usually in pairs, sometimes in 3's ; outer empty scales usually purplish or purple, the first scale wanting or sometimes present as a scarious rudiment, the second and third scales about equal in length, slightly shorter than the flowering scale, the second scale 3-nerved, the margins and internerves pubescent with appressed hairs, the third scale 7-nerved, the margins and the second and also often the first internerves on each side similarly pubescent, the fourth scale deep chestnut brown when mature, striate, acute ; palet of equal length and similar texture.

Introduced into waste places and fields and along roadsides, particularly in sandy sterile soil, Nova Scotia to Ontario and South Dakota, south to Florida, Louisiana and Kansas.

SYNTHERISMA LINEARIS MISSISSIPPIENSIS (Gatting.).

Panicum glabrum var. *Mississippiensis* Gattinger, Tenn. Fl. 95. 1887.

Differs from the above in having usually somewhat longer racemes and the first scale of the spikelet nearly always present.

Cedar barrens around Nashville, Tenn. Up to the present this grass is known only from the collections of Dr. Gattinger, who states that it is confined to argillaceous soils, entirely disappearing on calcareous.

9. SYNTHERISMA SETOSA (Desv.).

Digitaria setosa Desv. ; Hamil. Prod. Pl. Ind. Occ. 6. 1825.

Panicum Hamiltonii Kth. Enum. Pl. 1 : 84. 1833.

Culms 4–10 dm. tall, slender, branching, tufted, smooth and glabrous, at length decumbent at the base and rooting at the lower nodes ; nodes 4–several : culm leaves 4–several ; sheaths loosely embracing the culm, usually shorter than the internodes, the lower ones short, densely papillose-hirsute with spreading hairs, the uppermost one elongated, glabrous or nearly so ; ligule a scarious ring about 1 mm. long ; blades 2–12 cm. long, 2–7 mm. wide, flat, spreading or ascending, papillose-hirsute on both surfaces, especially in the lower leaves, rough on the margins : panicle long-exserted, its axis 4 cm. or less long, smooth and glabrous : racemes 4–13, 4–13 cm. long, finally widely spreading, usually in a whorl at the base and the remainder alternate or approximately in pairs, the rachis triangular, the lateral angles winged, the wings about .15 mm. wide, hispidulous on the margins: spikelets about 2.5 mm. long, about .5 mm. wide, lanceolate, acuminate, in pairs, occasionally with a delicate basal bristle, on 3-angled pedicels, the angles hispidulous; first scale minute, triangular, glabrous, the second scale about one-half as long as the spikelet, 3-nerved, the margins and internerves pubescent with appressed hairs, the third scale 7-nerved, the margins and second internerve on each side pubescent with appressed hairs, the fourth scale slightly less than 2 mm. long, noticeably shorter than the third scale, elliptic, greenish when mature; palet of equal length and similar texture.

Dry sandy soil, Florida. Also in the West Indies and South America.

10. SYNTHERISMA SANGUINALIS (L.) Dulac, Fl. Hautes-Pyr. 77. 1867.

Panicum sanguinale L. Sp. Pl. 57. 1753.
Digitaria sanguinalis Scop. Fl. Carn. Ed. 2, **1**: 52. 1772.
Syntherisma praecox Walt. Fl. Car. 76. 1788.
Paspalum sanguinale Lam. Encycl. Ill. **1**: 176. 1791.
Panicum ciliare Retz. Obs. **4**: 16. 1779–91.

Culms 1 meter or less long, at first erect, at length branched, finally prostrate at the base and rooting at the lower nodes, smooth and glabrous; nodes, 3–many; culm leaves 3–many; sheaths loosely embracing the culm, shorter than the internodes, the lower densely papillose-hirsute, the upper sparingly so or glabrous; ligule a scarious ring 1–2 mm. long; blades 4–20 cm. long, usually less than 10 cm., 4–10 mm. wide, flat, erect or ascending, more or less papillose-hirsute on both surfaces, rough on the margins; panicle finally exserted, sometimes much so, the axis 1 cm. or less long, smooth and glabrous: racemes 3–10, usually 5 or 6, 5–18 cm. long, commonly 8–12 cm., erect or ascending, very rarely spreading, minutely pubescent at the base, usually digitate, sometimes with an approximate pair or two above or below the whorl, the rachis triangular, the angles broadly winged, the wings .3–.5 mm. wide, hispidulous on the margins; spikelets 2.5–3 mm. long, about .8 mm. wide, elliptic-lanceolate, acute, in pairs, on 3-angled pedicels, the angles hispidulous; first scale minute, triangular, glabrous, the second scale about one-half as long as the spikelet, ovate-lanceolate, 3-nerved, the margins and internerves pubescent with appressed hairs, the third scale about as long as the flowering scale, 7-nerved, the outermost lateral nerves sometimes very faint, the first and second nerves on each side, especially the second, hispid above the middle, the margins and the second internerves on each side pubescent with short appressed hairs, which sometimes finally become spreading, the fourth scale yellowish-white when mature, acutely apiculate, elliptic-lanceolate; palet of equal length and similar texture.

In cultivated places, fields, roadsides, etc., throughout North America, but principally in the north. In the south it is replaced by the following species.

11. SYNTHERISMA FIMBRIATA (Link).

Digitaria fimbriata Link, Hort. Reg. Bot. Berol. **1**: 226. 1827.

Culms 8 dm. or less long, at length branching, prostrate at the base and rooting at the lower nodes, smooth and glabrous; nodes 4–many, usually more or less pubescent: culm leaves 4–many; sheaths loosely embracing the culm, shorter than the internodes, the lower ones short, densely papillose-hirsute with spreading hairs, the upper one sparingly so or glabrous, longer; ligule a scarious ring about 2 mm. long; blades 2–8 cm. long, usually more than 4 cm., 5–10 mm. wide, flat, erect or ascending, both surfaces, as well as the margins, rough, at least toward the apex, both surfaces glabrous or more or less pubescent, the upper surface at the base also with a few long stiff spreading hairs arising from papillae: panicle long-exserted, the axis 2 cm. or less long, smooth and glabrous; racemes 2–9, usually 5–8, 2–12 cm. long, commonly 5–8 cm., erect or ascending, alternate, in pairs or whorls or various combinations of these, the rachis triangular, the lateral angles winged, the wings .2–.3 mm. wide, hispidulous on the margins: spikelets 3–3.5 mm. long, about .8 mm. wide, lanceolate, very acute, on 3-angled pedicels, the angles hispidulous, in pairs, the long-pedicelled one often more copiously pubescent with longer hairs; first scale minute, triangular, glabrous, the second scale from three-fifths to four-fifths as long as the spikelet, lanceolate-cuneate, 3-nerved, the margins and internerves pubescent with long appressed hairs, the third scale slightly exceeding the flowering scale, 7-nerved, the margins, the second internerve on each side and also often the first internerve on one or both sides pubescent with long appressed hairs which at length usually become widely spreading, the fourth scale lanceolate, very acute, yellowish white at maturity; palet of equal length and similar texture.

Dry sandy soil, District of Columbia to Florida, west to Texas and Mexico; also from Missouri and Kansas southward. While this approaches in some of its forms *S. sanguinalis*, it can readily be separated by its longer narrower and more acute spikelets with their more copious pubescence, the longer second scale, and the smooth nerves.

12. SYNTHERISMA BARBATA (Willd.).

Digitaria barbata Willd. Enum. Hort. Berol. 91. 1809.

Panicum barbatum Kth. Enum. Pl. **1**: 84. 1833.

Culms 5 dm. or less long, decumbent at the base and often rooting at the lower nodes, branching, smooth and glabrous; nodes several: culm leaves several; sheaths flattened, keeled, short, smooth and glabrous; ligule a membranous ring about 1.5 mm. long, truncate and irregularly toothed at the apex; blades lanceolate, 3 cm. or less long, 3–5 mm. wide, flat, more or less spreading, glabrous and smooth on both surfaces, or the upper surface a little rough, the margins rough, sparsely ciliate at the base: panicle long exserted; racemes in pairs, 4–6 cm. long erect or ascending, the rachis 3-angled, the lateral angles winged, the wings about .2 mm. wide and hispidulous on the margins: spikelets 3.5–4 mm. long, slightly exceeding 1 mm. in breadth, lanceolate, acute, in pairs, on 3-angled pedicels, the angles hispidulous; outer scales empty, the first scale minute, triangular, glabrous, the second and third scales pubescent with very long hairs, the second scale about four-fifths as long as the spikelet, lanceolate-cuneate, 3-nerved, the appressed pubescence, consisting of hairs thickened at the apex, on the margins and internerves, the third scale 7-nerved, in the short-pedicelled spikelet the pubescence, which is similar to that on the first scale, confined to the margins only, in the long-pedicelled spikelets the pubescence on the margins and also on the second internerve on each side, and on the internerve also a row of much coarser subulate hairs, the pubescence of the internerves finally widely spreading, the fourth scale yellowish white at maturity, elliptic-lanceolate, acuminate; palet of equal length and similar texture.

Introduced into Mississippi. Collected at Starkville by Professor S. M. Tracy on July 21, 1892, and distributed as *Panicum glabrum*.

New Plants from New Mexico.—II.

By E. O. Wooton.

Selinocarpus lanceolatus.

Perennial with a ligneous root from which arise numerous diffusely branching stems 1–2 dm. high which are slender, woody at the base, terete, tumid at the nodes, pulverulent pubescent; leaves opposite, subsessile, ovate-lanceolate, 1–3 cm. long, 5–8 mm. wide, entire, obtuse, fleshy, bluish-green color (drying dark-colored), glaucous, pubescent with small scattered scale-like hairs; flowers axillary, sessile, solitary though at first appearing geminate in the upper axils, bracts subulate: calyx tubular-funnelform, 4 cm. long including the ovary; tube slender, fleshy, hirtellous; limb light yellow with five thickened ribs: stamens 5, little exserted; filaments attached for about ⅔ of length of tube, free from just below the throat, involute in the bud; anthers 2-celled, flattened, elliptical, attached by their inner edges to the connective, versatile, dehiscent along the outer edges: fruit oblong-prismatic, 6 mm. long, with five indurated angles upon which are membranous wings 2–3 mm. wide, membranous between the angles; seed single, suspended by a 1 mm.-long funiculus from the top of the pericarp.

Collected on white soil (mostly gypsum?) just south of the White Sands, August 26, alt. 4000 feet, no. 389.

First collected by Dr. H. H. Rusby near El Rito, N. M., July, 1889 (no. 357) and referred to as *S. diffusus* Gray to which it is closely related, but from which it may be separated by its solitary flowers, and fleshy, narrower, glaucous, not scabrous leaves.

Berberis haematocarpa.

Branching shrub 1–2 m. high with yellowish sapwood, bark grayish and shreddy on the older and brownish on the younger stems: leaves inclined to be fascicled, 4–7 cm. long, pinnately 3–7-foliolate, subsessile, the proper petiole 5 mm. long or less; stipules laciniate; leaflets stiff, coriaceous, ovate to oblong-lanceolate, 1.5–4 cm. long, 5–10 mm. wide, terminal leaflets 1.5–2 times as long as others, glabrous, very little reticulated, only the more prominent veins showing, margin with 2–4 pairs of sinuate spinescent teeth: racemes fascicled with the leaves, equalling or slightly surpassing them, 5–7-flowered; pedicels 8–14 mm. long; bracts broadly ovate, acuminate, 1–3 mm. long, persistent: fruit an oval to spherical berry of rather transparent blood-red color and pleasant acid taste, 7–8 mm. in diameter, ripening in southern New Mexico in August; seeds brownish red, elliptic-ovate, slightly flattened, 4 mm. long, 2 mm. broad.

Collected at the Mescalero Agency in the White Mountains, August 23, alt. 6300 feet, no. 376.

I first saw this plant in the Organ Mountains, August 4, 1895, in Fillmore Cañon at an altitude of 6300 feet, in company with Mr. E. N. Plank, as told by him in *Garden and Forest* **9**: 322, but it is in no way closely related to *B. Fendleri* as there stated.

But this is by no means the first time it was collected. Dr. Torrey had what I take to be this plant before him on several occasions and confused it with what he finally described as *B. Fremontii* Bot. Mex. Bound. 30.

It is *B. pinnata* Torr. Sitgr. Rept. 155 (not Lag.) from near Peach Springs, Ariz., Oct. 24, 1851, in fruit, and Emory's Recon. 137, from the Mimbres Mountains in New Mexico, Oct. 17, 1846; *B. trifoliata* Torr. in Whipples' Rept. (not Moric.) in so far as it refers to the above named specimens and probably the Gregg specimen (which I have not seen); and *B. Fremontii* Torr. Bot. Mex. Bound. 30 in part, in so far as it refers to the above named specimens, and Capt. E. K. Smith's specimen from Cañon of the Guadaloupe in southwestern New Mexico or Sonora, and Thurber's specimen from Mule Spring, New Mexico, May, 1851, no. 277. *B. Fremontii* Britton and Kearney (not Torr.) Trans. N. Y. Acad. Sci. **14**: 29. 1894, referring to Mrs. Hoyt's specimen from Ft. Apache, Ariz., *B. Fremontii* Britton (not Torr.) *l. c.* **8**: 62. 1889–1890, referring to Dr. Mearn's specimen, no. 266, from Ft. Verde, Ariz., 1884, and Rusby's specimen from Ash Forks, Ariz., June 11, 1893, belong here.

The characters of the flowers drawn from some of the above mentioned specimens are as follows:

Two ovate-lanceolate and 3 broadly ovate bracts at the base of the flower, the first adhering to the pedicel, the others sepaloid: proper sepals petaloid, obovate, 3 of them clawed, 5–7 mm. long, 3 mm. broad: petals elliptical-obovate, not clawed, slightly shorter than the longest sepals, crisped, sometimes emarginate to retuse, with a pair of glands at the base: stamens about the length of the petals; filaments stout, appendicular teeth mere rounded projections at the base of the anthers, hardly noticeable: ovary ellipsoidal, constricted above and below, with a subsessile umbilicate stigma 1.4 mm. in diameter.

B. Fremontii is correctly characterized in Syn. Fl. 1. pt. 1. 69, as having its leaflets ovate to oblong, and the terminal one not over an inch long while the filaments are noticeably appendiculate. In *B. hæmatocarpa* the flowers are smaller, the appendages to the filaments hardly noticeable, the terminal leaflet is longer, and all leaflets are narrower.

Our plant may be *B. Nevinii* Gray, but with the short description in Syn. Fl. and only a single specimen without flowers or fruit (collected by Dr. Franceschi) at my command it is impossible to be certain. The above mentioned specimen has thinner and larger leaflets, with more numerous and weaker teeth, and is with the type from Los Angeles Co., Calif., while the range of our species, as shown by the specimens above referred to seems restricted to the mountains of New Mexico and Arizona.

FALLUGIA PARADOXA (Don) Endlicher, var. ACUMINATA.

Differing from the typical (Mexican) plant by having much more dense pubescence on the leaves and stems and sepals having but one acuminate to subcarinate cuspidate tip, while the type is described and figured as tricuspidate. Collected on the mesa near Las Cruces, July 1, alt. 4100 ft., no. 65.

Dr. Torrey figured the varietal form in Emory's Recon. Pl. 2, and all material which I have seen that has been collected in New Mexico and Arizona belongs here. Two specimens from southwestern Texas, in this herbarium, agree with Don's description and figure of the Mexican plant.

SPHAERALCEA LOBATA.

Perennial, several erect branching stems from the suffrutescent base, 1–1.5 m. high or even higher in favorable locations; whole plant scurfy with a close stellate pubescence which is easily rubbed from the stems: leaves triangular-lanceolate in outline, 6–10 cm. long, 2–4 cm. wide, even the uppermost leaves 3-lobed, the basal ones 3–5-lobed, the middle lobe largest, oblong to triangular in outline, obtuse, lateral lobes rounded, sinuses shallow, irregularly crenate-dentate, veins prominent and very scurfy; petioles 1–3 cm. long, ascending: flowers in clusters in the axils of the reduced upper leaves forming an elongated leafy panicle; peduncles 1–3 cm. long, pedicels 3–10 mm. long; involucral bracts 3, linear-subulate: calyx-tube campanulate, persistent, 2–4 mm. long, limb of 5 ovate acute segments of same length as tube: petals obovate, 10–14 mm. long, 10 mm. broad, orange-vermilion (drying rose colored), on some plants a light pink: staminal tube antheriferous only at the top: carpels 12–15, elliptical-oblong, reticulate on sides near the base, smooth above, cuspidate, cusp 1–2 mm. long; seeds usually two in each cell, finely pubescent, slightly flattened.

Collected at Mesilla, July 14, where it is a common fence-row and ditch-bank weed. Altitude 3900 feet, no. 2.

This has been collected by most of the collectors in the southwest, for it is a common plant in that region, but has generally been referred to *S. cuspidata* (Gray) Britton (*S. angustifolia* var. *cuspidata* Gray). The most typical specimen of it in Columbia Herbarium has "*S. angustifolia* var. *cuspidata* passing to *Fendleri*" upon the sheet in Dr. Gray's handwriting. In the field it is easily separable from either of these species. *S. Fendleri* is only about half the size of either of the others, being rarely over 7 dm. high, and has deeply 5-lobed leaves. *S. cuspidata* has much the size and habit of *S. lobata*, but its upper leaves are narrowly oblong and not lobed and only the lowest leaves are obscurely 3-lobed, while all are more or less folded together along the midrib, the flowers are slightly more orange-colored, and although I watched carefully for color variation in the thousands of plants passed during the summer, I saw none whatever.

GAURA NEO-MEXICANA.

Several curved ascending stems from a ligneous root, each branching above into several erect to ascending virgate branches bearing terminal spikes; bark brown and shreddy below; whole plant villous with hairs of various lengths, spreading hispidulous on the lower portion of the stem, some of the hairs curved and subappressed upon the middle and upper parts, mostly so on the leaves, becoming finely viscid glandular and spreading upon the inflorescence: leaves lanceolate, 5–10 cm. long, 8–16 mm. wide, acute, decurrent, subsessile, subentire to slightly sinuate with a few inconspicuous blunt calloused teeth: flowers rather large, 2.5–3 cm. long, sessile; bracts ovate-lanceolate, 5 mm. long, caducous: calyx-tube 1 cm. long, finely villous within for upper third of its length; limb of four narrowly oblong-spatulate segments slightly longer than the tube: petals obovate, 1 cm. long, short-clawed, rose pink: stamens of equal length; filaments terete, somewhat thickened, scale at base terete, obtuse, 0.2 mm. long; anthers oblong, 3 mm. long, versatile: style slightly surpassing stamens, finely villous below the middle: stigma with four terete lobes adherent to a circular indusium about half the diameter of the spread lobes; ovary fusiform, 4-lobed: fruit obovate-pyramidal, 7–8 mm. long, 3–4 mm. broad, angles rounded until mature when they are acute, a prominent single ridge upon each side reaching from the base slightly past the middle where it almost disappears, not pediceled nor tranversely rugose nor contracted at the base.

Collected on the south fork of Tularosa Creek three miles east of the Mescalero Agency in the White Mountains, July 25. Alt. 6500 feet, no. 204. It is most nearly related to *G. biennis* L.

SCROPHULARIA MONTANA.

Herbaceous annual? 1–1.5 m. high, branched above, spreading: stems acutely striate-angled, glabrous below: leaves opposite or sub-opposite, more or less broadly lanceolate, 8–15 cm. long, 2–5 cm. broad, acute, decurrent to a petiole 0.5–2 cm. long, finely glandular-pubescent especially upon the veins, lighter colored beneath, coarsely serrate with mucronate teeth or upper leaves subcrenate: inflorescence a terminal elongated panicle 2–3 dm. long, peduncle and pedicels very glandular, pedicels 1–2.5 cm. long, bracts linear-lanceolate, 1 cm. long or less: calyx segments ovate, obtuse, 3–4 mm. long, glabrous, but little united at the base, persistent: corolla ventricose-oblong, glabrous, 6–8 mm. long, 3–4 mm. in diameter, lurid purplish, the upper lip 2-lobed, projecting in the same straight line as the tube, exterior in the bud, lateral lobes shorter and spreading, lower lobe still shorter and reflexed: stamens 4, included; filaments stout, stipitate-glandular, rudiment subsessile, rounded: stigma globular, included; style glabrous, broadening at the base; ovary conical, 2-celled with thick honeycombed central placentae, disk prominent: fruit a coriaceous conical capsule 10–15 mm. long, 5–8 mm. in diameter with prominent sutures on the sides, its rounded base subtended by the persistent calyx and apex tipped by the persistent style; seeds small, numerous, brown, rugose.

Collected on Eagle Creek near Gilmore's Ranch in the White Mountains, August 5th. Altitude 7000 feet, no. 280. First collected about six miles south of the above place on Ruidoso Creek, June 23, 1897.

This species is most nearly related to *S. leporella* Bicknell, but may be separated from that species by the narrower, shorter petioled, more finely toothed leaves and the generally longer and more narrowly conical fruit.

SAMBUCUS NEO-MEXICANA.

Arborescent, 3–5 m. high with erect rather smooth-barked trunk 5–10 cm. in diameter, symmetrically branched above, forming a round head 2–3 m. in diameter: leaves pinnately 3–7-foliolate; leaflets lanceolate to narrowly ovate-lanceolate, 6–12 cm. long, 2–3 cm. wide, with inquilateral rounded base, acuminate, thick, margin finely serrate-dentate; petiolules 1 cm. long or less, glabrous or puberulent: flowers cream-colored, in a flat-topped, five-rayed compound terminal cyme 1–2 dm. across; peduncles and rays glabrous and slightly glaucous: fruit black, glaucous, berries spherical, 6–7 mm. in diameter, very numerous.

Collected at Ruidoso Crossing, in the White Mountains, August 2 and 19. Altitude 6200 feet, no. 648. Also collected about five miles further up Ruidoso Creek, at an altitude of about 7000 feet, June 23, 1895.

What I take to be the same plant I found in the Organ Mountains May 15, 1892, but this sends up numerous stems without a main trunk and the young branches and peduncles are closely puberulent.

The White Mountain specimens agree fairly well with "*S. glauca* var. foliolis auguste lanceolatis" Gray, Pl. Wright. **2**: 66, from near the Copper Mines, October, 1851, and the Organ Mountain specimen agrees exactly with no. 423 of the Boundary Survey collections from Ben Moore Mountain, N. Mex., June, 1851, which Dr. Torrey refers to the plant mentioned by Dr. Gray.

This species seems to be somewhat intermediate between *S. Mexicana* and *S. glauca*, *i. e.*, taking the well-grown tree of the valleys of southern New Mexico and Arizona and northern Mexico to be the plant Presl had in mind when he wrote the name *S. Mexicana*.

S. Mexicana has broadly-elliptical to obovate, abruptly acuminate leaflets little over half as long as those of *S. Neo-Mexicana*, its fruit is slightly smaller and in southern New Mexico is rarely seen, only a few berries on the many-flowered cymes maturing, and the trunk is always rough and gnarled. It is always to be found in the valleys below irrigation level, while our plant grows only in the mountains, so far as I have observed.

S. Neo-Mexicana seems much nearer to *S. glauca*, but its leaves are little over half as wide as those of that species and there is a noticeable tendency to puberulence upon peduncles and leaves.

SICYOS GLABER.

Annual? stems slender, 4–6 m. long, climbing over bushes, striate, glabrous except near the nodes and towards the growing ends, where they are viscid villous; tendrils 3–4-branched from a stout base 3–5 cm. long: leaves thin, 5–12 cm. long and almost as broad, 5-lobed, lobes triangular-ovate, the terminal one larger and short acuminate, mucronate, margin coarsely sinuate-dentate with mucronate teeth, deeply cordate, the sinus 2–2.5 cm. deep and 3–4 cm. wide not overlapping, upper surface scabrous with tuberculate white hairs, lower surface more sparingly hairy with weaker hairs; petioles 0.5–5 cm. long, viscid with a pubescence which follows up the main veins especially on the upper surface of the leaf: staminate flowers in strict racemes, 15–20-flowered, 1–2 dm. long; peduncles viscid, pedicels 3–4 mm. long, glabrous, somewhat recurved; flowering peduncles some distance from end of stem: calyx-teeth very small or obsolete: corolla yellow; tube broadly companulate with wide spreading 5-parted limb, segments ovate, glabrous: filaments united into a column 2 mm. long, villous, head of anthers globose, 2 mm. in diameter, little exserted, anther cells contorted: pistillate flowers in a 6–12-flowered head, peduncles 3–5 mm. long in flower, elongating to 1–2 cm. in fruit, flowering peduncles near the tip of the stem among very young leaves and tendrils; whole flower 4 mm. long, greenish: calyx-teeth wanting: corolla-tube articulated to ovary, funnelform, glabrous, limb 5-lobed: style glabrous; stigma capitate, rather large, slightly exserted, no staminodia: ovary ellipsoidal, sparingly ciliate: fruit slightly compressed, ovoid, 5 mm. long, entirely glabrous, the outer coat thin, the inner indurated, black, tuberculate-roughened.

Collected in the Organ Mountains south of San Augustine Ranch, September 1. Alt. 5000 feet, no. 606. First collected on the other side of the same mountain range September 17, 1893.

This plant belongs in the subgenus *Eusicyos* and, judging from the description, is most nearly related to *S. Galeottii* Cogn. Monog. Phan. **3**: 883.

The Histology of the Embryo of Indian Corn.

W. W. Rowlee and M. W. Doherty.

(Plate 342.)

The general appearance of the kernel of Indian corn is familiar to every one. The embryo is literally at the base of the seed and, on the side adjacent to the endosperm, has a shield-like expansion of the hypocotyl—the scutellum—which has been interpreted usually as the cotyledon. There is a close coherence between the tissue of the scutellum and the tissue of the endosperm. On this account it is difficult to separate the embryo from the remainder of the seed without destroying some of its tissue. A well-marked layer of columnar epithelial cells, belonging to the scutellum, separates the embryo from the endosperm.

The axis of the embryo consists of the radicle, which is below the point of attachment of the axis to the scutellum, and the plumule, above the point of attachment. There is no obvious hypocotyl. The radicle is completely encased in the coleorhiza or root-sheath. Unlike many other grasses there is no epiblast present in the embryo of corn.

Calyptrogen. At the apex of the root is a distinct calyptrogen from which by periclinal walls the root-cap is formed (fig. 1). The many-layered root-cap, in its younger, more internal part, consists of parenchymatous tissue without intercellular spaces; in the older, more external parts, it is loose and in many respects degenerated. The root-cap by its origin and development must be considered a modification of the epidermal tissue system.

Dermatogen. Immediately within the calyptrogen, occurs a single row of cells somewhat elongated radially and with a thick outer wall. This is the dermatogen (fig. 1), and is the formative tissue of the epidermis. In the course of development the layers resulting from divisions of the dermatogen exfoliate and the layer of the cortex, which functions as an epidermis, is designated an epiblem.

Periblem. This arises from a single layer, and indeed apparently from an initial cell, at the apex of the root. In examining many sections, it was found that in no case did the dermatogen and periblem originate from a common initial cell. On the contrary, the initial cells of the two tissues appear quite distinct as do also the cells resulting from their divisions. This observation does not agree with that of Bowers (Prac. Bot.), who finds that "the periblem and dermatogen merge into a single layer of cells at the apex of the plerome. Thus the extra-stellar tissue of the root of maize comes primarily from a single initial row of cells."

Plerome. At the growing point the plerome consists of closely packed tissue. It soon differentiates into a peripheral region, the procambium, and a central region—the medulla. At a short distance from the apex of the plerome and well within the medulla appear rows of larger cells. Traced backward from the tip, these rows of cells are seen to increase in size much more rapidly than the surrounding tissue and simultaneous with their enlargement their nuclei break up and finally disappear altogether. After attaining full size and losing almost all their contents, their walls begin to show reticulated thickenings. Whether the agency in the thickening is the cell of the row or the cells abutting on the row, is not at present certainly known. Their appearance led at first to their being regarded as in no way related to vascular elements but the characteristic thickening points toward that relationship. They are very unique structures and so far as we can find they are confined to the grasses. Most species of grasses, if indeed not all, have them, some having only a single one in the center of the root while others, such as the species we are studying, has several of them.

The Root. For a study of the permanent structure of the root, cross-sections taken at some distance from the growing tip serve best. This shows the xylem and phloëm arranged radially (fig. 2). Strongly thickened and narrow-lumened cells make up the ground tissue which surrounds the xylem and phloëm strands. Every ray of xylem consists, in its outer part, of a group of very small elements, and, in its inner part, of very large and isolated ducts (pseudo-vessels). In each ray of phloëm the sieve tubes stand principally in a circle, the companion-cells occupying the inner part. The xylem and phloëm are separated laterally by several rows of cells. The wide-lumened vessels toward the center are not in direct line with the outer xylem elements and stand quite isolated. They have somewhat thickened fibrous elements however, immediately around them. The medulla is made up of ordinary conjunctive tisssue.

The Stem. The bundles of the stem of corn present the well-known collateral type with the characteristic vessels, figures of which are given in most of the botanical text-books.

Transition of Bundles in passing from Root to Stem. The change from the collateral bundles of the stem to the radial bundles of the root, presents in this plant an interesting peculiarity. In tracing the course of the bundles from the root back to the stem it at once becomes apparent* that the radial type of bundle is maintained in the internode above the scutellum (fig. 3). The structure in the root and in this first internode is so similar that it is practically impossible to separate slides with cross-sections of the one, from slides with cross-sections of the other. The radial type is maintained throughout the whole length of the internode. In this respect our observations do not coincide with those of Potter (see Proc. Camb. Soc., **4**: 1883). He says "above the node," (node at which the bundles are given off to the scutellum) "we find the protoxylem the most internal part of a more or less continuous ring of xylem show that the rotation is complete." The only change in the internode that we could discover was a slight lateral expansion of the phloem strands. Sections cut directly on the other side of the second (sheath) node show true stem structure both as regards the position of the elements composing the bundles, and the distribution of the bundles through the mass of ground tissue.

Course of the Vascular Bundles in the Embryo. It will be most convenient to trace the bundles from the root backward into the stem and leaves. In the root we have the true radial arrangement of the xylem and phloëm strands. The outer edge of both strands abuts directly upon the endodermis. They maintain this position the entire length of the root. At the first node a branch is given off to the scutellum. When they emerge from this node into the first internode, they show very little change either in structure or relative position. The vessels of the xylem have moved slightly outward and the large inner elements have become smaller (fig. 3). The phloëm has spread slightly laterally. This latter change becomes more apparent as we approach the second node and is the first step in the transition from radial to collateral arrangement. In the second node the elements composing the bundles decrease. This decrease is accompanied by a bending of the bundle outward. The phoëm of the primary bundles then disappears and only a very few of the xylem elements are distinguishable. Before the disappearance of the phloëm of the root, the xylem of the leaf-trace bundles makes its appearance. These leaf-trace bundles arise, either internally or externally or laterally in close proximity to the root bundles. They pass toward the center of the stem, the xylem and phloëm elements of the bundle at once assuming the collateral position. The bundles of the sheath and the first leaf originate in the same manner.

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*This should properly be designated a false internode. The node at the insertion of the sheath appears from the description which follows to be the first true node, the scutellum node a false node.

Four collateral bundles segregate into two pairs at almost opposite points in the node, then pass out with a sharp curve into the sheath. This curve of the leaf-traces of the sheath is so sharp that in cross-section many of the xylem elements are cut lengthwise. The leaf-trace bundles of the first leaf pass inward to near the center of the stem and upward through the second internode. After traversing about one-half the length of the second internode they commence to curve outward and at the third node pass out into their leaf. In the cross-section of this node a new set of bundles much smaller than those just considered, and about equal in number to them, make their appearance. They are the bundles which pass into the leaves above. The course of the bundles in the succeeding nodes and internodes corresponds to the type of bundle distribution found in palms and other monocotyledons.

In conclusion: 1. The bundles of the primary root of Indian corn are of the true radial type. 2. The innermost elements of the xylem are anomalous and doubtfully to be considered as true ducts. These anomalous elements occur in many species of grasses but have not been met with in other orders. 3. The leaf-trace bundles of the scutellum do not in any way affect the arrangement of the main bundles, and in this respect rather resemble the bundles given off to the secondary roots. 4. The first internode closely resembles the root in structure. The peculiar arrangement of the bundles may be in some way related to the failure of the first internode to attain a diameter greater than that of the primary root. 5. The fibro-vascular bundles change from the radial type to the collateral type in the second node. These bundles on entering the second node pass outward and terminate blindly toward the periphery, the last elements to disappear being the xylem elements. 6. The bundles of the sheath differ from those of normal leaves in that they originate in the node from which they are given off, that they blend into pairs and finally in the sheath appear as two bundles at opposite points on the axis, and that the curves of this bundle in the node are very sharp.

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Explanation of Plate 342.

1. Longitudinal section of root-tip. 2. Cross-section of root. 3. Cross-section of first internode. Ep. Epidermis. C. Cortex. Pc. Procambium. B. Pseudo-vessels. C.C. Plerome. R. Root-cap. En. Endodermis. Pe. Pericycle. Xy. Xylem. S. Secondary root. K. Large vessels. Pl. Phloëm.

Notes and Descriptions of North American Plants.—I.

By John K. Small.

Saxifraga Napensis.

Perennial by very short rootstocks, scapose, almost glabrous or sparingly grandular-pilose above. Leaves basal; blades thinnish (drying very thin), more or less obliquely oval or ovate, 2–7 cm. long, rounded at apex, undulate, abruptly or gradually narrowed at base, ciliate, sometimes slightly pilose on both surfaces: petioles slightly shorter than the blades or longer, broadly winged: scapes erect, slender, 1.5–3 dm. tall, loosely-paniculate-corymbose: calyx glabrous or glabrate; tube broadly turbinate, nearly 1 mm. high; segments oblong or ovate-oblong, slightly longer than the tube, obtuse or acutish, gland-tipped: corolla white, 5 mm. broad; petals broadly oval or suborbicular, 2 mm. long, rounded or notched at apex, sessile or nearly so, 5–7-nerved: ovaries united to calyx-tube, surrounded by a conspicuous lobed disk: follicles short and stout, 4 mm. high, united to each other to about the edge of disk: seeds dark red, 0.3 mm. long.

On hillsides, Napa Valley, California.

Collected by J. M. Bigelow (Whipple's Expedition) and George Thurber, no. 496.

A species of lax habit, resembling *Saxifraga claytoniaefolia* more closely than any other member of the subgenus *Micranthes.* It differs from *S. claytoniaefolia* by its broadly oval or suborbicular 5–7-nerved petals.

Saxifraga Van-Bruntiae.

Perennial, bright green, minutely glandular-pilose or glabrate below. Stems tufted, 2–7 cm. long, simple, or sometimes corymbosely branched above, leafy to the top: leaves alternate; blades linear, 4–8 mm. long, leathery, blunt, with a thick apex, sessile, turning black at the base of the plants: calyx glabrate in age: tube broadly turbinate; segments oblong or ovate-oblong, obtuse, longer than the tube, spreading: petals yellow, oblong, about 4 mm. long, obtuse, firm, more or less crisped, much longer than the calyx-segments: stamens 10, filaments filiform.

The original specimens of this hitherto undescribed *Saxifraga* were collected by Mr. and Mrs. Cornelius Van Brunt during the past season on the summit of Sulphur Mountain near Banff, British Columbia. The species is related to *Saxifraga serpyllifolia* and *S. chrysantha*; the habit suggests those species but the stems are copiously leafy to the top and the leaves are narrower. The petals are smaller, of a much less brilliant yellow and oblong or ovate-oblong instead of oval-orbicular or obovate as they are in the two related species.

GALPINSIA TOUMEYI.

Perennial from a shrubby base, slender, bright green, puberulent. Stems branching near the base; branches erect or ascending, wire-like, 1–3 dm. long, usually simple above, leafy, pale when young: leaves numerous, sometimes clustered in axils; blades linear-spatulate to linear, 1–2 cm. long, acute, entire, with midrib prominent beneath, lower ones short-petioled, upper sessile: spikes few-flowered, leafy-bracted: calices very minutely pubescent; tube slender, 3–5 cm. long; segments about 1–5 cm. long, their free tips 5–6 mm. long: corolla yellow; petals orbicular-obovate, 1.5 cm. long, undulate: anthers linear, as long as the filaments: capsules linear-prismatic, 2 cm. long.

Arizona: Chincahua Mountains, July 25, 1894, J. W. Toumey, no. 197. Fort Huachuca, August, 1892, T. E. Wilcox.

The species just described is related to *Galpinsia Hartwegii*, but is of a much more slender build. There are minor characters in the foliage and habit, but one of the more crucial points of difference lies in the calyx, where we find the free tips of the segments 5–6 mm. in length.

LIMONIUM LIMBATUM.

Perennial, bluish green or glaucescent. Leaves basal; blades leathery, spatulate or oblong-spatulate, 0.5–1.5 dm. long, obtuse or notched at the apex, prominently nerved beneath in drying; petioles shorter than the blades or rarely longer, margined: scapes erect, solitary or several together, corymbosely branched; branches zigzag, ascending; spikes in dense terminal corymbs: bracts suborbicular or sometimes orbicular-oval, obtuse, often eroded at the apex, hyaline-margined: calyx trumpet-shaped with a flaring limb, nearly 4 mm. long; tube hirsute; segments broadly deltoid, apiculate: corollas bright blue.

In alkaline soil, Texas and New Mexico.

As far as I can learn there has been no attempt heretofore to separate the Texan plant referred to *Limonium Californicum* either varietally or specifically. An examination of considerable material both from the Texas and the Californian districts discloses the fact that there have been two perfectly distinct species confused under the old *Limonium Californicum.* As in the case of all the species of the genus the two under consideration resemble each other in habit. The diagnostic characters are contrasted below:

Limonium Californicum. Calyx narrowly funnelform; tube glabrous; segments erect or nearly so, rounded and mucronulate.

Limonium limbatum. Calyx trumpet-shaped; tube hirsute; segments more or less spreading, broadly deltoid.

The following specimens belong here: Wright, no. 1435; Woodhouse, Zuni Mts., N. M., Aug., 1851; Wooton, no. 172.

ANDROSACE DIFFUSA.

Annual, acaulescent, more or less pubescent. Leaves basal; blades oblanceolate to spatulate or nearly linear, 1–4 cm. long, obtuse or acute, sharply serrate above the middle or sparingly toothed near apex only, sessile or with short winged petioles: scapes erect and spreading, often diffusely branched at base, 5–10 cm. long or shorter: bracts lanceolate: pedicels filiform, very variable in length, often 1–8 cm. long in the same cluster: calyx campanulate to turbinate-campanulate, 3–3.5 mm. high; segments triangular, acute, ciliate, about ½ as long as the 5-ridged tube; corolla white or pink, included, sometimes equalling the tips of the calyx-segments, 3–3.5 mm. broad; segments oblong, obtuse or retuse at apex, about as long as the tube: filaments shorter than the anthers: capsules subglobose, about 3 mm. in diameter.

In rocky soil, western Arctic America to the Dakotas, New Mexico and Arizona. Spring and summer.

For some inexplicable reason the species here described as new has always been associated with *Androsace septentrionalis* with which it has not even a habital resemblance. *Androsace septentrionalis* is a plant with strict, conspicuously elongated scapes which are surmounted by umbel-like clusters of pedicels of nearly equal length, whereas *Androsace diffusa*, has comparatively short, more or less diffusely spreading scapes, while the pedicels of the clusters are exceedingly variable in length. A more tangible character exists in the corolla. In *Androsace septentrionalis* this organ conspicuously surpasses its calyx while in the newly described species it is shorter than its calyx or barely equals it.

ANDROSACE SUBUMBELLATA (A. Nelson).

Androsace septentrionalis subumbellata A. Nelson, Bull. Wyom. Exp. St. 28: 149. 1896.

Annual, diminutive, sparingly pubescent. Leaves basal; blades thick, oblong, 2–8 mm. long, obtuse, entire, sessile: scapes 1–5 mm. long, or wanting: bracts ovate-lanceolate or lanceolate, pedicels solitary or several together, 5–10 mm. long: calyx nearly glabrous, turbinate-campanulate, 2.5 mm. high; segments triangular, acute, slightly shorter than the 5-ridged tube: corolla white or pink, 2.5–3 mm. broad, surpassing the calyx; segments oblong, obtuse, or retuse at the apex, shorter than the tube; filaments much shorter than the anthers: capsule globose-pyriform, about 2 mm. thick.

On hillsides, near summit of Union Peak, Wyoming. Summer.

In order to treat this genus consistently, we should recognize the above as a species. On the one hand *Androsace subumbellata* is related to *Androsace diffusa*: this species it resembles in habit and foliage, but it is more diminutive in all its parts. On the other hand it is related to *Androsace septentrionalis* in having the corolla exserted beyond the calyx.

PRIMULA SERRA.

Perennial, glabrous or nearly so, deep green. Leaves basal, 5–10 cm. long; blades narrowly oblong or spatulate, much longer than the broadly winged petioles, rather regularly dentate, acute or apiculate: scapes erect, 1–2 dm. tall, solitary or several together: bracts scarious, ovate-lanceolate, acuminate, often minutely pubescent: pedicels 1–3 cm. long, glabrous in age: calices 6–7 mm. long; tube campanulate; segments lanceolate, granular-ciliate, acuminate, as long as the tube or shorter: corollas lilac-purple; tube as long as the calices or somewhat longer; segments suborbicular or obovate-orbicular, notched at apex, 7–8 mm. long, destitute of apiculations.

Primula serra resembles *Primula Rusbyi* in habit, but both the foliage and the inflorescence furnish characters for distinguishing the two species. In the case of the species just described we find more coarsely toothed leaf-blades and shorter petioles; but more prominent characters exist in the inflorescence: The calices are twice as large as those of *Primula Rusbyi*, the corolla-tubes are comparatively stout and they never twice exceed the length of the calices as do the very slender tubes of *Primula Rusbyi.* In addition, the lobes of the corolla-segments are destitute of the minute but characteristic apiculations found in the related species.

The original specimens were collected by Mr. Pringle on damp ledges, Santa Rita Mountains, Arizona, at an altitude of 8000 feet, on July 25, 1884.

PRIMULA TENUIS.

Perennial, glabrous, bright green. Leaves basal, 0.5–1.5 cm. long; blades oblong, oval or suborbicular, undulate or toothed, obtuse or acutish, much shorter than the slender petioles: scapes erect, wire-like, 5–10 cm. tall, solitary: bracts linear-subulate, 1–5 mm. long: calices 3–5 mm. high, tubes turbinate, segments narrowly lanceolate to narrowly linear, longer than the tube, acute: corollas pink, 4–5 mm. broad; tubes surpassing the calices, 4 mm long, notched at the apex.

In moist places, Pastolic, Alaska.

A delicate species related to *Primula borealis*, but much more slender; easily distinguished by its flimsy leaves, shorter pedicels turbinate calyx-tubes and narrow calyx-segments. The corolla tube is further exserted than in *Primula borealis* and the more delicate lobes less deeply notched.

The original specimens were collected by W. H. Dall, on June 25, 1871, or 1872.

New Species of Fungi.

By Chas. H. Peck.

TRICHOLOMA ODORUM.

Pileus fleshy, convex, becoming nearly plane or slightly depressed, subumbonate, glabrous, shining when young, soft like kid, yellowish or pale tan color, flesh yellow, flavor at first nutty, then farinaceous, odor strong, jessamine-like; lamellae broad, rounded behind, adnexed, easily separating from the stem, thick, white or tinged with pink; stem equal, sometimes slightly bulbous, stuffed, silky-fibrillose, colored like the pileus but pale yellow toward the base and white and pruinose at the top; spores elliptical, 7.5–10 μ long; 5–6 μ broad.

Pileus 2.5–5 cm. broad: stem 5–7.5 cm. long, 6–10 mm. thick.

Among fallen leaves in moist places in woods. Tacoma Park, D. C. Mrs E. M. Williams.

The species is remarkable for its peculiar and strong odor, which resembles that of jessamine blossoms.

CLITOCYBE ECCENTRICA.

Pileus very thin, umbilicate or subinfundibuliform, glabrous, hygrophanous, watery white and shining when moist, white when dry, the thin margin often lobed, split or irregular; lamellae narrow, close, decurrent, white; stem slender, tough, solid, glabrous but strigose-hairy at the base, often eccentric, colored like the pileus, long branching strings of mycelium often permeating the matrix; spores minute, 4–5 μ long, 2.5–3 μ broad.

Pileus 2.5–5 cm. broad; stem 2.5–3.75 cm. long, 2–4 mm. thick.

Much decayed wood, Vermont. July. Prof. E. A. Burt.

CLITOCYBE MORBIFERA.

Pileus thin, fragile, glabrous, convex, becoming plane or centrally depressed, slightly hygrophanous, grayish-brown when moist, whitish or cinereous when dry, sometimes slightly umbonate; lamellae narrow, close, adnate or slightly decurrent, whitish or pallid; stem short, equal, hollow, colored like the pileus or a little paler; spores minute, broadly elliptical, 4 μ long, almost as broad.

Pileus 1.2–3.5 cm. broad; stem about 2.5 cm. long, 4–6 mm. thick.

Grassy ground and lawns. November. Washington, D. C. F. J. Braendle.

The species seems related to *C. expallens*, but the margin of the pileus is not striate as in that fungus. The taste is very disagreeable and remains in the mouth a long time. Two persons were made ill by eating it, but their sickness lasted only about three hours.

HYGROPHORUS SORDIDUS.

Pileus broadly convex or nearly plane, glabrous, slightly viscid, white, but usually defiled by adhering dirt, the margin at first strongly involute, then spreading or reflexed, flesh firm when young, tough when old; lamellae subdistant, adnate or decurrent, white or creamy white; stem short, firm, solid, white; spores elliptical, 6.5–7.5 μ long, 4–5 μ broad.

Pileus 5–10 cm. broad; stem 5–10 cm. long, 1.2–2 cm. thick.

Pine woods, Tacoma Park, D. C. November. Mrs. Williams.

A cobwebby veil is sometimes perceptible in young plants. The species is distinguished from *H. penarius* by its clear white color, though this is commonly obscured by the adhering dirt that is carried up in the growth of the fungus.

HYGROPHORUS AMYGDALINUS.

Pileus thin, convex or nearly plane, glabrous, slightly viscid when young, grayish-brown, the margin incurved, naked, odor amygdaline; lamellae thin, subdistant, adnate or decurrent, white; stem rather long, slender, solid, equal or rarely narrowed at the base, minutely scurfy or squamulose, slightly viscid, grayish-brown, paler at the base; spores oblong-elliptical, 10–12.5 μ long, 5–6.5 μ broad.

Pileus 2.5–3.5 cm. broad; stem 5–15 cm. long, 4–6 mm. thick.

Gregarious in pine woods, Tacoma Park, D. C. November. Mrs. Williams.

The species is related to *H. cerasinus*, from which it may be separated by its thinner grayish-brown pileus, its white lamellae with no pinkish hue, its grayish-brown stem and its larger spores.

HYGROPHORUS ALBIPES.

Pileus convex, glabrous, grayish-brown, the margin strongly decurved; lamellae narrow, subdistant, arcuate and commonly very decurrent, whitish, becoming darker with age; stem slender, solid, glabrous, attenuated at the base, white without and within; spores subglobose or broadly elliptical, 5–6.5 μ long.

Pileus about 1.2 cm. broad; stem 2.5–3.5 cm. long, 3–5 mm. thick.

Massachusetts. September. Dr. G. E. Francis.

The species is related to *H. Peckii* and *H. sphaerosporus*.

OMPHALIA AURANTIACA.

Pileus very thin, broadly convex or nearly plane, glabrous, striatulate when moist, pale orange, the margin inflexed; lamellae thick, distant, decurrent, pale orange; stem short, often curved, colored like the pileus; spores elliptical, 7.5 μ long, 4 μ broad.

Pileus 1.2–2.5 cm. broad; stem 1.2–2.5 cm. long, about 1 mm. thick.

Cespitose on old fir tree logs in woods, Portland, Oregon. February. Dr. H. Lane.

The whole plant is pale orange when fresh, but the pileus and stem lose their color to some extent in drying. The species differs from *O. umbellifera* in its cespitose mode of growth, orange color, more narrow lamellae and larger spores.

CANTHARELLUS SPHAEROSPORUS.

Pileus thin, broadly convex or subinfundibuliform, glabrous, grayish-brown; lamellae few, narrow, distant, sparingly branched, decurrent, cinereous; stem slender, flexuous, solid, colored like the pileus; spores globose, 7.5–10 μ broad.

Pileus 1.5–3 cm. broad; stem 2.5–3.5 cm. long, about 4 mm. thick.

On the ground. Frenchman's Cove, Newfoundland. Rev. A. C. Waghorne.

CANTHARELLUS CANDIDUS.

Pileus thin, 8–20 mm. broad, dry, hairy-tomentose, sessile, often attached by the vertex, either even, longitudinally plicate or concentrically sulcate, white; lamellae narrow, branched or sparingly anastomosing, straight, wavy, crisped or interrupted, white or whitish.

Decaying wood of birch, Frenchman's Cove, Newfoundland. August. Waghorne.

A variable species apparently intermediate between *Cantharellus* and *Trogia*.

NAUCORIA PLATYSPERMA.

Pileus convex, becoming nearly plane, glabrous, slightly tinged with ochraceous or reddish-yellow when young, soon whitish, the margin at first adorned with vestiges of a white flocculent veil, flesh white; lamellae moderately close, slightly rounded behind, pallid, becoming brownish; stem equal, stuffed with a white pith, slightly flocculent or furfuraceous above when young, whitish, the mycelium sometimes forming white thread-like strands; spores broadly elliptical, 15 μ long, 12.5 μ broad.

Pileus 2.5–3.5 cm. broad; stem 3.5–5 cm. long, 2–4 mm. thick.

On the ground, Compton, California. Professor A. J. McClatchie.

This species differs from *N. pediades* and *N. semiorbicularis*, to which it is related, by its larger broader spores and paler color.

CREPIDOTUS PUBERULUS.

Pileus thin, reniform or suborbicular, nearly plane, minutely pubescent, brown; lamellae rather broad, ventricose, rusty-brown when mature, whitish on the edge; stem short, equal, curved, lateral or eccentric, brown, with a thin suborbicular patch of white mycelium at the base; spores subelliptical, 9–10 μ long, 5–6 μ broad.

Pileus 6–10 mm. broad; stem 2–4 mm. long.

On decaying wood, Compton, California. March. McClatchie.

The species is related to *C. haustellaris* and *C. tiliophilus*, differing from the former by its darker brown color and its equal brownish stem, from the latter by its smaller size and darker and more pubescent pileus, and from both by its spores. The pileus is sometimes almost resupinate. The color of the mature lamellae is nearly vandyke brown. The spores are generally uninucleate.

CREPIDOTUS SEPIARIUS.

Pileus thin, convex, subumbilicate, even, very minutely squamulose, grayish-tawny; lamellae adnexed, minutely crenulate on the edge, tawny; stem short, curved, generally eccentric, rarely central, brownish, sometimes mealy or pulverulent; spores broadly elliptical, 9–10 μ long; 6 μ broad, commonly uninucleate.

Pileus 4–8 mm. broad; stem 2–4 mm. long.

On oak rails, Michigan. January. Prof. W. J. Beal.

The grayish tint of the pileus is due to the minute grayish floccose squamules. Occasionally the stem is central and the pileus is slightly umbilicate.

AGARICUS TABULARIS.

Pileus very thick, fleshy, firm, convex, deeply rimose-areolate, whitish, flesh whitish, tinged with yellow, the areolae pyramidal, truncate, the sides horizontally striate, their apices sometimes tomentose; lamellae narrow, close, free, blackish-brown when mature; stem short, thick, solid; spores broadly elliptical, 7.5–9 μ long, 6–7.5 μ broad, generally containing a single large nucleus.

Pileus 5–10 cm. broad; stem 2.5–5 cm. long, 1.5–2.5 cm. thick.

In clay soil by roadsides, Craig, Colorado. August. E. Bethel.

This species is remarkable for the peculiar upper surface of the pileus which is broken into pyramidal areas. The sides of these are marked by parallel lines in such a way that they appear as if formed by small tablets placed one upon another, each successive tablet being a little smaller than the one immediately preceding it. Only dried and broken specimens have been seen by me and the notes of the collector do not give the color of the young lamellae. There is a trace of a thick annulus on the broken stem of one specimen.

HYPHOLOMA AMBIGUUM.

Pileus thin, convex, becoming nearly plane, glabrous, subviscid when moist, straw color inclining to pale orange, the margin in immature plants appendiculate with the remains of the white thick veil which in very young plants conceals the lamellae, but which in mature ones wholly disappears; flesh white; lamellae close, adnexed, grayish at first, changing to dark brown where wounded, becoming blackish-brown with age; stem slender, equal, stuffed or hollow, squamose near the base, paler than the pileus; spores elliptical, 12.5–15 μ long, 7.5 μ broad.

Pileus 5–13 cm. broad; stem 12–22 cm. long.

Fir woods. Portland, Oregon. November. Lane.

The dried specimens have the general appearance of some species of *Stropharia*, but the appendiculate character of the veil and the entire absence of an annulus indicate that the species is a *Hypholoma*.

GOMPHIDIUS OREGONENSIS.

Pileus at first convex, becoming nearly plane or somewhat centrally depressed, viscid, brown or dark-brown, becoming black in drying, taste sweet and pleasant; lamellæ numerous, rather close, adnate or slightly decurrent, blackish in the dried plant; stem short, solid, equal or slightly tapering upward, colored like the pileus; spores oblong, 10–12.5 μ long, 4–5 μ broad.

Pileus 5–10 cm. broad; stem 2.5–5 cm. long, 4–10 mm. thick.

Fir woods, Oregon. September to December. Lane.

Dr. Lane writes that this species is edible and grows so abundantly in fir woods that it might be gathered by wagon loads and might be made a source of an abundant food supply.

SOLENIA ANOMALOIDES.

Densely cespitose, tufts 2–6 mm. broad; cups stipitate, cyathiform, one-fourth to one-half a line broad, externally clothed with an appressed villosity, grayish-ochraceous or subcervine, whitish within, the margin incurved; spores oblong or cylindrical, 10–12.5 μ long, 3–4 μ broad.

Dead bark of plum trees. Michigan. February. Beal.

This species is closely related to *S. anomala*, but the cups are more expanded, the villosity appressed and the spores longer. Neither do the cups appear to spring from a visible floccose mycelium.

CLAVARIA NEBULOSA.

Clubs simple, closely gregarious, 2.5–12 cm. high, fragile, hollow, narrowed toward each end, isabelline or clay color, sometimes clouded with darker hues, apt to become blackish in drying; spores oblong or narrowly elliptical, 6–7.5 μ long, 3.5–4 μ broad.

Sandy soil, Sandy Point, Newfoundland. September. Waghorne.

STEGANOSPORIUM ACERINUM.

Acervuli subcutaneous; spores oozing out and forming black masses on the surface of the matrix, obovate, 50–60 μ long, 25–30 μ broad, four- to five-septate, the upper cells vertically or obliquely divided.

Bark of sugar maple, Ottawa, Canada. September. Prof. J. Macoun.

Closely related to *S. piriforme*, but distinct by its larger spores. It is perhaps this fungus which in Grevillea **2**: 153, is referred to *S. cellulosum*, but according to Sylloge Fung. **3**: 804, the spores of that species are much smaller.

SPHAEROPSIS FERTILIS.

Perithecia numerous, closely and uniformly scattered, erumpant, surrounded by the elevated remains of the ruptured epidermis, black; spores elliptical or oblong, 17–27 μ long, 12.5 μ broad.

Dead branches of green ash, *Fraxinus viridis*, Rockport, Kansas. February. E. Bartholomew.

This differs but little from *S. biformis*, except in having the perithecia more numerous and more uniform in size and position.

CHROMOSPORIUM ATRORUBRUM.

Effused, forming a thin dark red or rubiginous pulverulent stratum; spores globose, verrucose, 7.5 μ broad.

Decaying wood of pine, Ottawa, Canada. September. Macoun.

Under a lens, the spores appear to be collected in minute clusters. The hyphae are not conspicuous, the spores forming the chief part of the stratum and giving color to it. The globose spores separate it from *C. lateritium* and *C. rubiginosum*.

HYPOMYCES PURPUREUS.

Subiculum effused, purple, permeating, transforming and discoloring the matrix; perithecia minute, sunk in the subiculum, the ostiola emergent, black; asci cylindrical; spores fusiform, uniseptate, purple, with a cusp-like point at each end, 35–40 μ long, 7.5 μ broad, oozing out and forming beautiful purple masses or patches on the surface of the matrix.

Pennsylvania. August. Charles McIlvaine.

The species is similar in all respects to *H. lactifluorum*, except in color. It is apparently parasitic on some species of *Lactarius*, but the host plant is so transformed and discolored that the species is not recognizable.

HYPOMYCES INAEQUALIS.

Perithecia subsuperficial, easily separable from the host plant crowded, forming a continuous stratum, pallid or pale pinkish-brown, the ostiola prominent; asci slender, cylindrical, 125–150 μ long, 6–7.5 μ broad; spores subfusiform, hyaline, septate near the base, commonly acute or slightly pointed at the apex and obtuse at the base, sometimes acute at both ends or obtuse at both ends, 15–20 μ long, 5–6 μ broad.

Parasitic on some stout thick stemmed agaric, Maine. September. C. L. Fox.

The perithecia attack both pileus and stem and prevent the expansion of the former. According to the notes of the collector, the perithecia are at first a dingy pink or flesh color, becoming yellowish-white from the copious effusion of the spores. Sometimes the ostiola appear hyaline when viewed by transmitted light. The species is peculiar in having the septum of the spores near the base as in the spores of *Plowrightia morbosa*. This divides the spore into two unequal parts and suggests the specific name. By this character the species may be distinguished from *H. Vanbruntianus* and *H. Banningiae*.

MICROGLOSSUM CONTORTUM.

Clubs 2.5–5 cm. long, 4–6 mm. thick, cespitose or scattered, compressed, curved, contorted or irregular, dark bay or brown when moist, blackish and longitudinally wrinkled or grooved when dry; asci narrowly clavate, 87–112 μ long, about 7.5 μ broad, 8-spored; spores oblong-fusiform, hyaline, 12.5–15 μ long, 5–6 μ broad.

Deep woods, Rock Creek Park, D. C. May. Mrs. Williams.

Allied to *M. multiforme*, from which it differs in its larger size, larger spores and its usually tufted mode of growth and irregular twisted or contorted clubs.

Mycological Notes.—III.

BY BYRON D. HALSTED.

Relation of Bacteriosis to outward Conditions.—Some notes that may be of interest to mycologists were made upon a plot of bush beans during the past season. The rows ran nearly north and south and upon the east side of the plants there was but a small amount of the bacteriosis, due to *Bacillus phaseoli* Sm., to be seen while upon the west side nearly every pod of the "green flageolet" variety was more or less blotched, many of them literally covered with the bacterial ulcers. The engraving, figure 1,

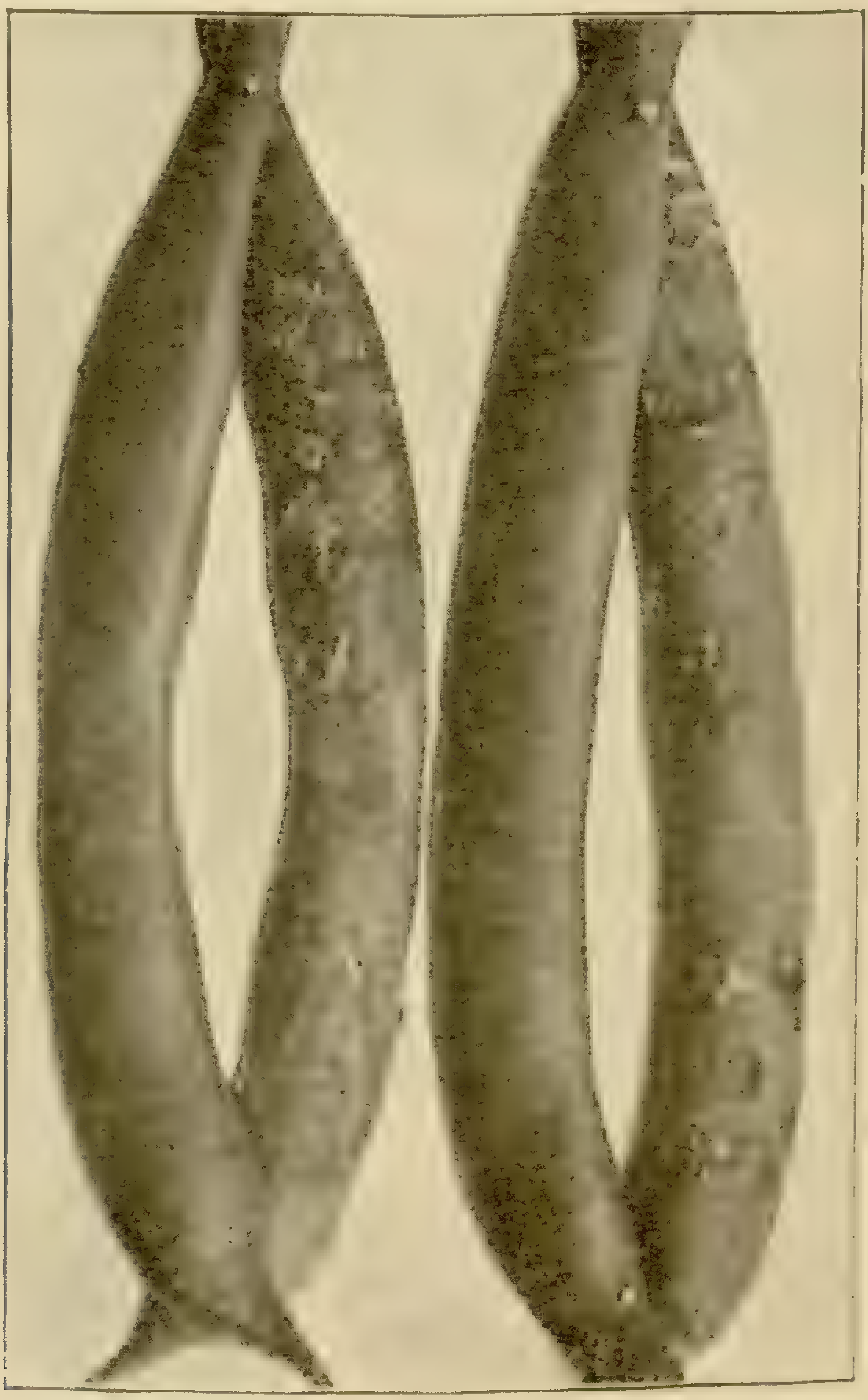

FIG. 1.

shows two sample pods split to expose both sides, the upper in each case being healthy and grown with an eastern exposure, while the western halves of the same pods are shown below their respective mates, and were badly diseased. The ulcers were in many instances of an amber color, due to the multitude of the germs of the bacillus that had collected in a layer upon the surface.

Fully nine-tenths of all the blotches were upon the western sides of the pods and about two-fifths of all the pods of the variety in question were badly affected.

Strong winds upon the 17th and 20th of September bent the plants to the southeast, from which they did not fully recover. As a result, at the time the above observations were made, October 5th, the plants all leaned several degrees from the perpendicular and some of the pods were likewise tilted. In short, the foliage of the plants hung chiefly upon the eastern side of the row and had done so for between two and three weeks, and therefore one side of each pod was more exposed than the other, and that exposure was, speaking generally, in the direction of the four o'clock sun.

It had been previously observed that the leaves of the plants under consideration were badly blighted for weeks before the pods became noticeably injured, and it is not unlikely that the germs were carried from the diseased leaves to the pods by the dripping dews, in which case the side that was slightly inclined upward on account of the slanting posture of the plants would receive a more generous supply of the germs than the more protected underside.

It is possible that the bending of the plants so exposed the pods that they became more or less injured by the sun and thus provided more favorable conditions for the development of the bacteria. The warmth of the sunny side may have been sufficient to make the difference observed.

All the circumstances may have combined to bring about the results that were so strikingly evident. The bending of the plants and the swinging of the foliage to the eastward, the inclining of the pods and the exposing of the upper surface, that would naturally receive the drips from the diseased leaves, the autumn sun during the afternoon, either adding the required warmth for the germs or partially scalding the side most exposed and thus render the tissues more susceptible to attack are all still open questions.

One cannot but wonder what the result might have been had the plants been pressed back into place after the storm or a portion of the plot been shaded or even if the rows had run east and west instead of north and south.

The Hollyhock Rust.—Mr. J. A. Kelsey, Assistant at the plant hospital, brought me upon March 23d some badly rusted hollyhock leaves from the ornamental grounds of a person living in the suburbs of New Brunswick. The teleutosporic sori of this rust (*Puccinia malvacearum* Mont.) are very prominent and stand up almost like beads from the surface of the leaf. They are more abundant upon the under than the upper side of the leaf, but may arise anywhere even upon the long petioles.

Upon the leaves examined the sori were in all stages of formation, from the mere yellow orange discoloration of the affected tissue to the fully developed, nearly spherical masses of teleutospores. These latter are at first of a light brown color, but the point of most interest in this connection was the gray appearance possessed by many of the sori, particularly upon the upper side.

The first thought upon noticing this wide difference in color, namely that the spores were undergoing germination proved correct, for upon making a microscopic examination the upper cell of each teleutospore in a majority of cases had sent out its promycelium and developed the sporidia. It was the luxuriant growth of these hyphae and spores that had given the peculiar appearance to the sori that under a hand lens looked as if attacked by some delicate mould.

It would seem that this species of *Puccinia* produces teleutospores in very early spring, and that these germinate at once and by the time the hollyhock is ready to form new leaves there is a large crop of sporidia ready to infect them.

No signs of any aecidium form is met with in connection with the Hollyhock rust, and the uredo is apparently absent, making this species one of the Leptopuccinia group. The fungus winters as hibernating hyphae in the tissue of the rosette of leaves and start into full vigor at the first suggestion of spring.

During this season the hollyhock rust has been used for class demonstrations of promycelium and sporidia instead of the *Gymnosporangium macropus*, which it precedes by several weeks, and is altogether more satisfactory because it can be easily cultivated for weeks in the laboratory.

Witches Broom upon Asparagus.—The "witches broom" of the cedar caused by species of *Gymnosporangium* and of the cherry by *Exoascus cerasi* (Fl.) have received their full share of attention in works upon fungi; but the writer fails to note any mention of a similar growth upon asparagus.

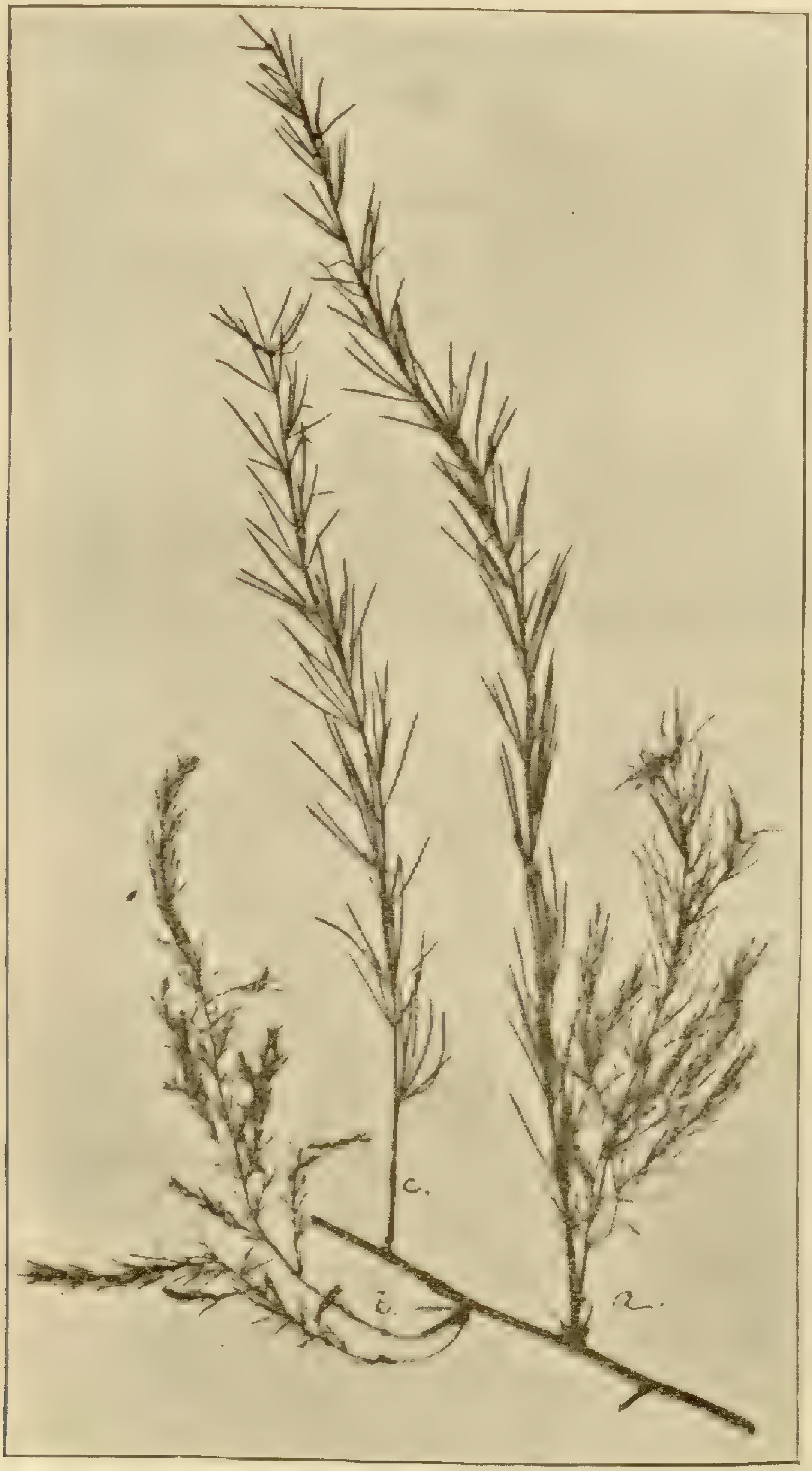

FIG. 2.

During the past year while visiting various fields in a study of the rust (*Puccinia asparagi* DC.) it has been observed that in many instances asparagus plants otherwise entirely free from the rust would have one or more diseased tufts and these assumed an appearance that at once suggested the "witches brooms" of cedar and cherry trees, although upon a much smaller scale.

There seems to be no order as to their appearance, as sometimes they are near the tip of the main branch and again they are here and there along the stem as malformed lateral shoots. The engraving (figure 2) shows a small branch upon which there are two rusted twigs. The one at *a* is the lowermost branch of a side shoot, all other portions of which are normal. At *b* is shown a second rusted and dwarfed branch, while next above it is a normal twig. The differences between the infested and healthy branches are well shown in the engraving made from a sun print of the subject and one-third reduced. In the diseased parts the "leaves" while more numerous are not about half the ordinary size and there is a strong tendency to produce side branches and thus form the "broom." Sometimes the diseased branch develops so that there is a decided tuft, which tends to grow upright even if the main branch bearing it is more or less inclined. This tendency for a fungous infested branch to be perpendicular is as well illustrated in these "brooms" as in case of the prostrate euphorbias attacked by *Aecidium* or the common purslane when badly infested with white mould (*Cystopus portulacae*).

In case the asparagus plant is inoculated as its young succulent stems come above ground there is but little chance of "brooms" to form and they therefore are generally met with in beds where the spores have not reached the plants until they are approaching full growth. The local disturbance indicates a local inoculation and the malformation shows how rapidly the fungus spreads in the host.

The Rose Speck.—Recently it was my privilege to visit a brand new greenhouse in which a middle bed of roses had recently been set out. The leaves of these plants were nearly all dotted over with minute circular black specks smaller than the head of a bank pin and jet black. The gardener was exercised over the sudden appearance of these numerous specks and desired a preventive.

The specks upon examination were found to be filled with spores, and, therefore, the dark somewhat oval circular dots were of fungous origin. It was also observed that the clean white woodwork of the greenhouse was also spotted in the same manner as the plants.

The fungus in question is *Pilobolus crystallinus* Tode., which is one of the Mucorini that had grown upon the horse manure used liberally in the bed and covered the surface of the soil under the rose bushes. This fungus produces its spores in black sporangia that are at maturity thrown to a considerable distance by the enlarged portion below the sporangium filled with liquid suddenly collapsing as the spore case leaves the tip of the filament. In this manner in the greenhouse in question the sporangia have been thrown upward to the roof, ten feet above the bed of manure, and the glass was spotted with the adhering spore specks.

Along one side of the rose bed is a glass partition wall and upon this was a record of the distance to which a majority of the sporangia may be thrown. Between two and three feet seemed to be the average distance or range of the mycological mortars in this microscopic bombardment.

It is scarcely necessary to state that the gardener's mind was put at ease when he determined the cause of the disfigurement of his rose and other neighboring plants.

Rust of the Safflower. During August, 1895, while spending a few days at Cottage City, Massachusetts, the writer's attention was attracted to a row of safflower (*Carthamus tinctorius*) growing in the quaint kitchen garden of a humble family of foreigners, probably Russians. The safflower plants, sometimes called false saffron, were probably grown both for their curious spinose orange heads of flowers and the dye that is contained therein. But it was the exceedingly distressing condition of the plants as a whole that made me look a second time over the extemporized garden fence of lath and various sticks. This led to a call at the house for the privilege of a closer inspection, which I trust was granted; however, no intelligible words passed between the owner and the visitor to verify the fact.

In short, the plants were found to be badly infested with a fungus that, upon microscopic examination turns out to be

Puccinia carthami Corda. Notice is here made of this find, for it appears to be the first time that this rust has been taken in the United States. The host plant is so rarely grown that it is not likely to be frequently met with. It is curious that in this foreign garden a rust should have developed so extensively as to show itself upon nearly every leaf, and doubtless had nearly ruined the crop. Possibly it came in from the native country in the seed of the *Carthamus*, or it may be some of the herb-leaf, branch and flower as a coloring material accompanied the immigrants. Saccardo records it for Silesia and Bohemia.

New Species of Sapindaceae from South America.

By Prof. Dr. L. Radlkofer.

Allophylus cinnamomeus.

Inter Allophyli species Americanus; foliis 3-foliolatis et inflorescentiis pluriramosis praeditas molliter pubescentes excellit, pube ramorum petiolorumque brevi cinnamomeo, foliolis breviter petiolatis, serrulatis, inflorescentiis fere a basi ramosis, floribus majoribus. (Fructus desunt.)

Legit M. Bang, Bolivia, n. 2236.

Matayba Boliviana.

Arbor 15-pedalis; rami teretes, novelli pube adpressa gilvo-cinerea induti; folia abrupte pinnata, 3–4-juga (ad 18 cm. longa); foliola subopposita, oblonga (circ. 8 cm. longa, 2.5 cm. lata), obtusa, integerrima, basi inaequaliter in petiolulos breves attenuata, subcoriacea, laevigata, nervis lateralibus numerosis oblique patulis venisque supra vix, subtus paullulum tantum prominulis, utrinque livescentia, subglabrata, sparsim pellucide punctata et lineolata, ad paginem superiorem hypodermate instructa; paniculae axillares, folia subaequantes, pubescentes; flores albi, disco glabro.

Affinis *Mataybae sylvaticae* (Casar) Radlk. in Sitzungsber. K. bayer. Ac. **9**: 631, 1879, a qua differt forma et colore foliolorum, indumento pallido et praesertim foliolis hypodermate instructis.

In Bolivia, legit M. Bang, n. 2171.

"Grows as a shade tree on the banks of streams, in rich forest mold. But one tree seen." *Bang. coll. notes.*

Serjania grandiceps.

Scandens, fruticosa, subglabra; rami acute 3-angulares, 3-lateri. lateribus inter angulos et costam medianam utrinque canaliculato-sulcatis, necnon angulis ipsis sulco angustiore exaratis, vix extimo apice laxepuberuli; corpus lignosum compositum e centrali majore et periphericis, parvis 6-triangulariter dispositis et per paria angulis sulcatis subjectis; folia biternata (circ. 14 cm. longa, 10 cm. lata): foliola ovalia (terminalia 8 cm. longa, 4 cm. lata, reliqua decrescentim minora), acuta, subpetiolata, supera medium remota serrato-dentata glabra, punctis pellucidus sparsis lineolisque reticulatis notata; petioli nudi; thyrsi elongati; flores magni; pedicellis (1 cm.) longis suffulti; sepala flavescenti-tomentelli (6 mm. longa); petala ex obovato in unguem longiorem attenuata (8 mm. longa, 4 mm. lata); stamina hirsuta; germen pyriforme, dense flavescente-tomentosum; fructus magnus (4.5 cm. longus, medio 3.5 cm. ad loculos 1.5 cm. latus), cordato-ellipticus, loculis globosis, sat liberis, reti venarum elevato notatis, subhirsutis, endocarpio crispato-piloso (semen non suppetebat).

Affinis vindetur *Serjaniae glabratae* Kunth; floribus serjaniam nutantem in mentem revocat, sed germen densius tomentosum; insignis est ramorum structura.

In Bolivia, legit M. Bang.

PAULLINIA DASYSTACHA (sp. nov. in Paulliniae Monographia mor fusius tractanda) in Sectione XII., "Caloptilon" (capsula trialata, alis endocarpii ingressa chartaceis persistentibus sepalis 5 liberis) quodammodo affinis *P. acutangulae* Pers.:

Tomentosa; rami subteretes; corpus lignosum simplex; folia 5-foliolato-pinnata; foliola ovato-oblonga, remote obtuse dentata, raro-punctata, epidermide non macigera; stipulae elongatae, sublanceolatae; thyrsi solitarii, rhachi tomentosa; fructus obvatus, truncatus vel emarginatus, breviter et stipitatus, alis basi angustatis, tomento brevi indutus; seminis testa parve pilosa.

Forma 1, *genuina* Radlk.: Dense hirto-tomentosa.

Forma 2, *hirta* Radlk.: In omni parte brevius et laxius tomentosa.

In Bolivia et Peruvia: Forma 1: Ruiz & Pavon! (Peruvia); Bang n. 2815! (Bolivia). Forma 2: Rusby n. 531: (Bolivia, Guanii, alt. 2000 ped., Maj. 1886, fruct.; *Paullinia acutangala* non. Pers., Britton in Bull. Torr. Bot. Club, **16**: 190, 1889; partim, excl. nempe coll. Rusby n. 530!, quae partim *Paullinia neglecta* Radlk. in Serg. Monogr., 1895, p. 42 et 71 n. 29, partim *Serjania Caracasana* Willd.

CUPANIA SEMIDENTATA.

Affinis *Cupaniae triquetrae* A. Rich. Fructu (potius germine aucto) subtriquetro et foliolis ad paginem superiorem hypodermate instructis, sed distincta indumento fructuum cano setoso-sericeo adpresso (nec flabescente lanoso-tomentoso) et foliolis elongate oblongis supra medium tantum crenato-dentatis, subglabris (nec ex obovata cuneatis, a basi repando-dentatis vel subintegerrimis, subrevolutis, subtus tomentellis); foliolis 7–9, alternis, brevi-petiolulatis, 10–20 cm. longis, 4–8 cm. latis; panicula longipedunculata, laxiuscula, circa 20 cm. longa, 10 cm. lata.

Collected by Rusby and Squires at Sacupana, lower Orinoco. A small tree of some 6–10 meters.

Two new Species.

By A. A. Eaton.

On August 26, 1896, while collecting the peculiar large form of *Spartina patens* growing on the border of the marsh at Seabrook, N. H., I noticed a taller, more slender plant growing in a clump of bushes. An examination showed it had many peculiarities, and an extended search on the 27th revealed numerous patches, and also showed beyond a doubt that it was a heretofore overlooked species, with external appearance of *S. patens*, with which it has doubtless been confounded. After once noticing it, however, one can distinguish it at sight.

Though growing in rough ground just at the edge of the marsh where it is never mown, it bears an abundance of leaves and seems to be preferred by cattle to *S. patens*, as I have repeatedly seen it cropped to the woody base, while *S. patens* growing beside it was untouched. The reason for this may be that it does not secrete so much salt on the upper surface of the leaves, owing to its growing where there is less in the soil. I will mention in passing that salt on various grasses growing in salt marshes is popularly supposed to be the residue from evaporated sea water. This is not so. That it is a true excretion of the plants is shown by the fact that in dry seasons on a low run of tide it is most abundant, and sea water will remove it as well as rain. Moreover, I have seen *Sporobolus airoides* and *Distichlis spicata* growing in alkaline soils in San Joaquin valley, California, where they had been several months without rain, whose leaves were more copiously supplied with salt crystals than I have seen *Spartina stricta* even, in the eastern marshes.

Spartina caespitosa. "Highwater Grass."

Plants caespitose, forming tussocks 3 dm. across, which are scattered 6–9 dm. or more apart. Rootstocks 2.5 cm. or less long, closely covered with short, broad, hard, shining mucronate scales, imbricated in two lateral rows, and sending up several branches at the end: culms very many, clustered 4–15 together at tip of rootstock, 6–12 dm. high, very smooth and glabrous, purplish where exposed, slender at base, usually lying flat at maturity, and geniculate above at two upper joints: sheaths smooth, much exceeding internodes below, equalling them or a little shorter above: leaves 4 or 5, usually secund, approximate near middle of stem, open, with distinct midrib, often keeled, about 6 mm. broad, involute when dry, glaucous above, yellowish green below, becoming reddish or purple as they ripen, lowest 1 dm. long, dead at flowering time; middle about equalling the culm, 2–6 dm. long, upper 2.5–10 cm. long, reaching base or middle of panicle, all with long involute scabrous points: (there is a small joint or knot in the leaf at about the upper third, more noticeable when dry, above which several of the nerves are scabrous, and the leaf tapers to a long filiform scabrous point) spikes usually 3, often 8, 2.5–3.5 cm. long, spreading, becoming erect but not appressed, 20–30-flowered, the common rachis very bristly on edges above, roundish and nearly smooth below: spikelets 1–1.2 cm. long, sessile or nearly so, lower glume two-thirds length of upper, or with its short rough awn point five-sixths as long, rough scabrous on back: second glume very rough-scabrous on back and gradually rough awn-pointed, the edges scabrous above top of palet: third glume with midvein rough-scabrous above middle, ending below the tip in a very scabrous point: palet hyaline, little or not at all longer than upper glume, two-thirds as long as middle one, boat shaped, finely scabrous above on midvein.

Differs from any form of *S. patens* by the cespitose habit, long, open, filiform-tapering, scabrous, erect leaves, scabrous common rachis, flowers sessile in lower glume, (stalked in *S. patens*) and empty glumes both more scabrous and rough awn-pointed, the second very prominently so.

In brackish, rather dry and firm soil at borders of marsh where wet by tide a few times a year, associated with *Elymus Virginicus*, *Panicum virgatum*, *Eleocharis rostellata*, and other coarse grasses of such places, often among bushes at border; one tussock at Seabrook, N. H., Aug. 26, 1896, species subsequently traced on both sides of marsh from Hampton, N. H., on the north, to Ipswich, Mass., on the south, most abundant at the causeway, Salisbury, Mass.

Eriophorum gracile Koch. is with us in condition to collect on June 1st. In the spring of 1896 I put off my trip for it till June 12th, when it was dead ripe. On June 29th, I noticed in two localities, Salisbury and Amesbury, Mass., an *Eriophorum* resembling it just coming into flower. I subsequently found it at Byfield, Mass., North Hampton, Hampton Falls, Seabrook, Nottingham, N. H., and several other localities, ranging in time from June 29th, when, as said, it was just developing, to August 10th, when its seed was all shed.

A reference to the fifth edition of Gray's Manual showed it was *E. gracile* var. *paucinervium* Eng. The sixth edition ignores it entirely or combines it with the type, and Britton & Brown, I., 273, figure and describe it as *E. gracile.*

Mr. M. L. Fernald of Harvard, to whom I referred the matter, kindly furnished the important literature on the species and variety, as well as a list of localities as represented by specimens in the Harvard Herbarium. From this it appears that *E. gracile* is spread from Newfoundland to Washington, south to about the 40th parallel, while the other reaches from New Brunswick to Illinois, no account of its being found farther west being at hand; while Watson (Bot. Cal. **2**: 220) certainly describes *E. gracile*, and Coulter (Text-book Western Bot. 368) may or may not include both. A careful study of an abundance of material from several localities shows this is entitled to specific rank.

Inasmuch as confusion exists as to the characters of *E. gracile*, which is certainly comparatively rare, it is best to give descriptions of both.

ERIOPHORUM GRACILE Koch. Roth. Catal. II (1799) addend 259.

Culms 3–6 dm., slender, terete or nearly so, smooth throughout, sending off from base lateral rhizomes, which become established as new plants and then send up 2–4 very slender channeled triquetrous solid leaves, 1.5–4.5 dm. long, from rather tight nodulose sheaths. The next year the culm is pushed up from within this crown of dead leaves, without any new radical leaves appearing; culm leaves mostly but one, never more than two, 1.5–2.5 cm. long, solid, bayonet-shaped; involucral scales 1–2, dull lead colored, the lower usually with a very short triangular-bayonet-shaped point, strongly several-nerved; spikes 3–4, one usually raised on slender smoothish pedicel, 0.5–5 cm.; outer scales broadly ovate, narrowing within to lanceolate, obtuse, dull lead or slate colored; bristles numerous, 1.2–1.5 cm. long.

May 25–June 10.

ERIOPHORUM PAUCINERVIUM (Engelm.).

E. gracile, var. *paucinervium* Engelm. Am. Jour. Sci. **45**: 105. 1846.

Larger every way than *E. gracile*. Culms 4.5–10 dm., stouter, obtusely three-angled, scabrous above upper leaf, sending off at base after flowering one or more slender rhizomes, each of which develops at tip into a new plant, and sends up 5–6 nodulose leaves 3–7.5 dm. long, 3–4 mm. wide, open, flat, or closed in drying, scabrous margined on a loose, more or less nodulose and fibrillose sheath; culm and 2–3 radical leaves develop next year from center: culm leaves 2 or 3, flat, with solid point sharply triangular in section, keeled below, mostly closing like a book when dry, lower, 2–3 dm. upper 0.5–1.5 dm. long, scabrous on edges: involucral scales 2, larger than *E. gracile*, lower usually 1.2 cm. long, with stiff triangular blade 2.5 cm. long or more; spikes 4–5, larger and more densely flowered than *E. gracile*; one or two usually raised 1.2–2.5 cm. on scabrous pedicels; outer scales ovate, inner narrower, obtuse, light yellowish brown or red tinged, with green midrib; bristles most abundant, 2–2.5 cm. long.

July 1–August 1.

E. paucinervium was so named by Engelmann to distinguish this plant from the European var. *pleurinervium*. He gives Illinois, Ohio and Pennsylvania as its habitat. The Harvard Herbarium contains specimens from St. Francis, Me. (Fernald), Rumford, Me. (Pailin), Wisconsin (Schnette), New Brunswick (Fowler), Beardstown, Ill. (Geyer).

About here it occurs in every place where *E. gracile* grows and in several localities where that does not. It grows often in water and sphagnum on water quaking bogs, while *E. gracile* prefers a firmer foundation. To summarize: It is about twice as tall as *E. gracile*, intermediate in robustness between that and *E. polystachyon*. The culms are more sharply angled, the leaves long, flat or channeled, while *E. gracile* has short, solid, bayonet-shaped ones. Its peduncles are rough and pedicels bristly, while both are smooth or nearly so in *E. gracile*. Its involucres are long bladed, scales lighter colored, cotton more copious and longer, and it is about five weeks later in fruiting.

SEABROOK, N. H., March, 1898.

Vitis labrusca and its westward Distribution.

By E. J. Hill.

Having found this grape the past summer growing wild in the woods of the dune region of Lake and Porter Counties, Ind., the question arose as to its range, since published statements are somewhat contradictory. In the last issue of the "Synoptical Flora of North America" (1897),* Professor Bailey says: "Not known to occur west of eastern New York in the north, but reported from southern Indiana, *Munson*." He remarks on the ease with which it may be confounded with *V. aestivalis*. In the Catalogue of the Plants of Indiana (1881), by the editors of the Botanical Gazette, it is reported from Jefferson County, which is in the southeastern part of the state bordering on the Ohio River. In the "Catalogue of the Flora of Minnesota" (1884) by Warren Upham, it is said to occur "frequently according to *Clark*, in the eastern part of the state as far northward as Pine County (Upper St. Croix), and rarely on the St. Louis River (Head of Lake Superior), Lake Pepin *Miss Manning*." Britton and Brown, in their "Illustrated Flora" (1897), give its range from New England to Minnesota, Georgia and Tennessee. Dr. Engelmann in The True Grapes of the United States, 1883,† says of it: "This species usually known as the Fox-Grape, or Northern Fox-Grape, is a native of the Alleghany Mountains and of their eastern slope to the southeast, from New England to South Carolina, where it prefers wet thickets or granitic soil. Here and there it descends along streams to the western slope of the mountains, but it is a stranger to the Mississippi Valley proper." "Large and downy-leaved varieties of *V. aestivalis* are in the west and southwest not rarely mistaken for *Labrusca*." Accordingly in some of his papers on *Vitis* he corrects such determinations as came to his notice.

In another paper the following statement is made: "*V. Labrusca* is our most local species, being confined to the Alleghany Mountains and the region between them and the Atlantic, unknown in the Mississippi Valley or beyond. Whatever has been called so there, or in Louisiana or Texas, is a large and downy-leaved form of *aestivalis*, always readily distinguished by its 'intermittent' tendrils, while *Labrusca* has more or less 'continuous' tendrils." * Since Dr. Engelmann was a very careful student of this genus, the question may be legitimately asked whether the determinations of the western forms were in all cases correct, and a careful inquiry should be made in those regions where it is said to occur. It is easy to confound *V. aestivalis* with *V. Labrusca* in the dune region if one were to base the determination on some forms of the leaves of the former species But the arrangement of the tendrils and especially the fruit clearly distinguish the two. I was greatly surprised that it had been overlooked so long in a region which is often visited by collectors, and was at first inclined to regard the vines as escaped from cultivation. But they were found in several localities, covering quite an area in one place, with vines running up on the trees thirty feet or more. But the fruit conformed in all respects to the wild type, and it would be necessary to assume a complete reversion to the wild state to explain their presence in the Lake region by this hypothesis. They were met with both in the dryer sands and damp thickets, the latter taking the greater number seen. As the sands are siliceous the two habitats agree very well with those given by Dr. Engelmann. The fruiting vines were relatively few. The berries were large, even larger than the average Concord grape of the market. Some were slightly depressed-globose, others a little elongated or plum-shaped. They varied in color from black to vinous purple, were without bloom, and though of good flavor and quite palatable they had the tough skin and pulp and the large seeds of the wild form. Some were sent to Prof. L. H. Bailey, who expressed surprise that they were found in this locality.

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* 1^1: 430.

† Botanical Works, 420.

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* Bull. Torr. Bot. Club, **6** : 234. 1878.

Two Southern Plants.

By Thomas H. Kearney, Jr.

MONOTROPSIS ODORATA Ell.

This little-known and attractive plant has been noted heretofore only at a few scattered localities east of the Alleghanies. I am now able to report a station for the species on the western slope of the Alleghanies, at Wolf Creek Station, Cocke County, Tennessee. While stopping at Wolf Creek last summer a "small leafless plant with the odor of violets" was described to me as growing in a ravine on the farm of my host, Mr. Allen, which I fancied could be none other than the *Monotropsis*. I requested that specimens be sent me when their flowering time should arrive, and to-day, April 6th, a number of plants reached me in excellent condition. The species has also been reported from Rugby, Morgan county, Tennessee, on the Cumberland plateau, a considerable westward extension of its range.

STYLOSANTHES RIPARIA Kearney, Bull. Torr. Bot. Club, **24** : 565. 1894.[*]

Dr. Charles Mohr sends me excellent specimens of this *Stylosanthes* collected at Auburn, Alabama, by Profs. Earle and Baker (129), July 8, 1897. They differ from the type in the somewhat longer and more abundant pubescence of the stems; in the longer (by .5–1 mm.) secondary bract and prophyllum, the latter cleft very nearly to the base; and in the usually somewhat longer lowest calyx-tooth. Occasionally the prophyllum of the lowest flower of the inflorescence is undivided, although in every inflorescence examined the other prophylla are constantly deeply cleft. No other differences were detected. *S. riparia* is represented in the Biltmore Herbarium by specimens from Delaware,[†] eastern North Carolina and Florida, all of them showing the deep cleft in the prophyllum, except that from Delaware, in which the prophyllum is not constantly cleft.

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[*] In the paper cited the following errata are to be corrected: P. 567, in the twenty-third line read "stems" instead of "culms;" p. 569, under *Rhododendron maximum*, read "1.5 m.," instead of "1.5 mm.;" p. 570, under *Vaccinium melanocarpum*, read "14 dm.," instead of "4 dm."

[†] C. D. Beadle; Bot. Gaz. **25** : 279. 15 Ap. 1898.

Proceedings of the Club.

TUESDAY EVENING, MARCH 8, 1898.

The club met by invitation at the Teachers College, where the science lecture rooms, laboratories and library were thrown open to its inspection and use, with reception and refreshments following, in which the ladies connected with the Teachers College staff dispensed their kind hospitality.

President Brown presided. About 140 persons were present.

The scientific program consisted of a lecture by Prof. Francis E. Lloyd, of the Teachers College, on the trees of the Pacific coast, illustrated with lantern slides taken by himself. He discussed the characteristic Pacific trees found between California and Sitka, especially those of the Olympic Mountains, showing among others the western representatives of the white oak, black ash and flowering dogwood. The Douglass Spruce, the western maple (*Acer macrophyllum*) and others were shown both in their regular closer-branched field-forms and in their irregular narrower forest-forms. *Abies grandis*, the White Fir of the West, and *A. lasiocarpa*, the Woollycone Fir, were shown from the Olympic Mountains. Pines occur there at the altitude of 5,000 feet and over, as *P. albicaulis*, the White-trunked Pine, bearing a round cone with thick, fleshy scales. Its seeds are the food of a curious crow inhabiting these mountains. This pine loves exposed situations, and also about Crater Lake, but always cowers under the wind, often forming a dense, broad, low mass on which one can lie as on a spring bed, perhaps 800 years old, while but four or five feet high. A curious contrast is afforded by the persistently erect trunk of *Tsuga Pattoniana*, the western hemlock, which grows with the preceding, but becomes erect no matter how strong the wind, nor how much its flexile trunks while young are decurved each winter by the snow. Several other pines were exhibited as *P. contorta* and its erect form of the interior known as *P. Murrayana*. Among Alaskan trees *Picea Sitchensis*, and the Alaska Cedar were discussed.

EDWARD S. BURGESS,
Secretary.

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Correns, C. Ueber die Vermehrung der Laubmoose durch Blatt- und Sprossstecklinge. Ber. Deutsch. Bot. Gesell. **16**: 22–27. 23 Mr. 1898.

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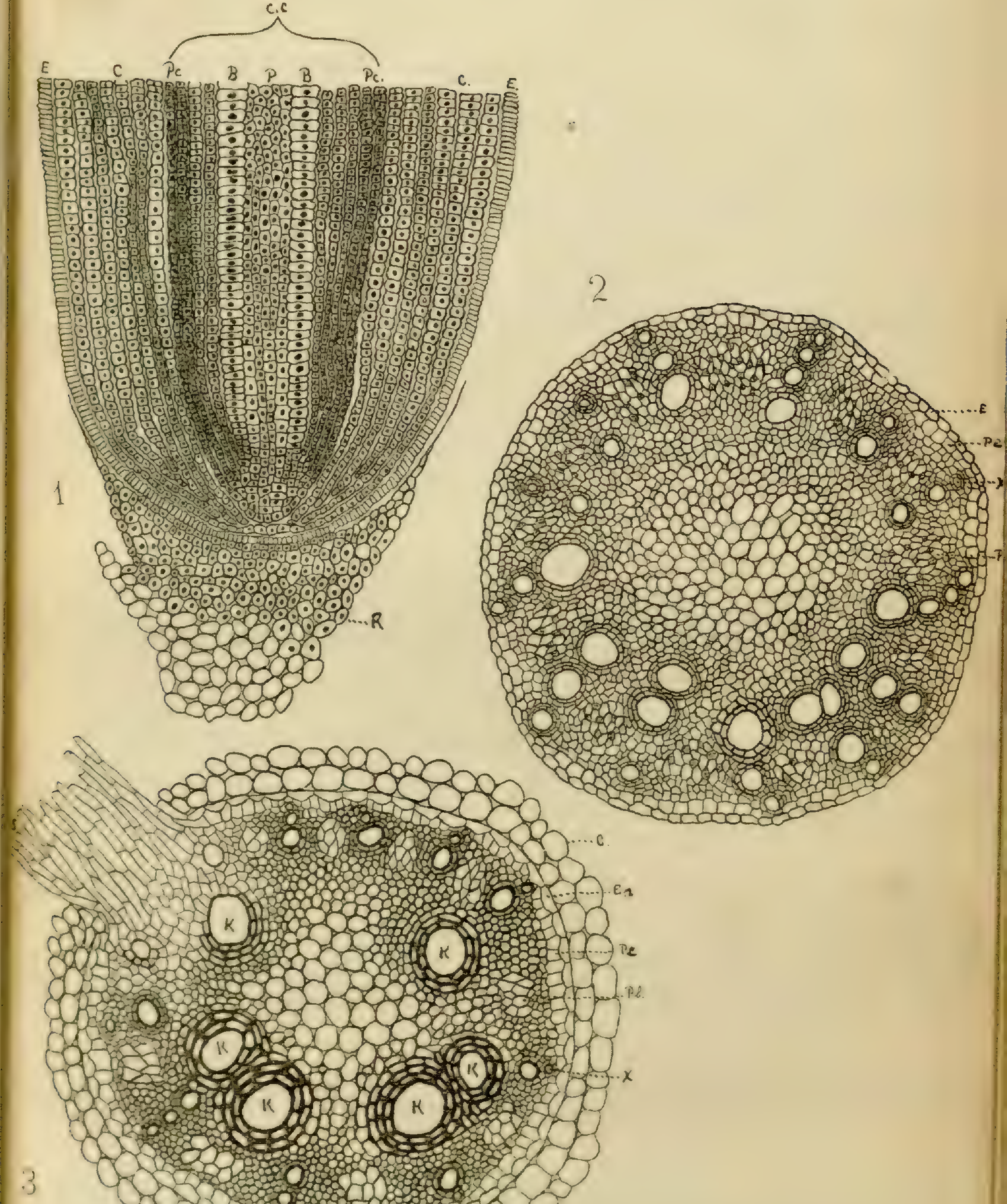
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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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BULLETIN
OF THE
TORREY BOTANICAL CLUB

JULY 1898

A Sketch of the Flora of the Canary Islands.

BY ALICE CARTER COOK.

The Canary Islands have the latitude of central Florida and are at the nearest point but seventy miles distant from the coast of the Sahara. Three islands lie to the east and three to the west of Tenerife, the largest member of the group, famous for its magnificent snow-capped volcano over 12,000 feet high. The geologic formation is entirely volcanic and the evidences of former seismic activity are everywhere apparent in the exceedingly mountainous, broken and jagged nature of the land surface.

The climate is semitropical and the average winter and summer temperatures differ only by about 10° C. There are clearly marked rainy and dry seasons—the former usually beginning in October and lasting until March. Whether the islands were once connected with the mainland or not is still a disputed question. The Challenger Report describes them as joined to Morocco and to Portugal by narrow submarine elevations. The flora has much in common with the Madeira and Cape Verde groups, but its general character is that of the Mediterranean region, including North Africa. A number of plants (species of *Erica*, *Umbilicus*, *Wahlenbergia*, *Romulea*, etc.) have South African affinities; others (species of *Visnea*, *Phoebe*, *Bosea*, *Myrica*, etc.) Indian, and still others (species of *Pteris*, *Asplenium*, *Pinus*, *Salix*, etc.) American. But the large proportional number (414 out of 1,226) of species* peculiar to the islands proves long isolation. Knowledge of the distribution of Canary plants and comparative study of them and

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* Christ in Engler's Bot. Jahrb. **6**: 459–526. 1885.

[Issued 15 July 1898.]

of their nearest relatives has a bearing on many important questions of the geologic and biologic history of the archipelago, as well as upon the more general problems of the distribution of life. At present, however, such study is largely handicapped by the want of systematic work of a sufficiently thorough and final character. For instance, the great work of Webb and Berthelot includes a large number of species which later writers, notably the English botanists, have placed as synonyms of south European forms. Webb and Berthelot had, however, wide and practical preparatory acquaintance with the flora of the Spanish peninsula and the character of their work justifies the placing of a high value upon their judgment in the field, at least in comparison with that of others working with herbarium specimens only. They spent eight years on the islands, a far longer period than all their successors taken together. They seem, moreover, to have had very advanced ideas with reference to both genera and species and often approximated more closely in views and methods to American workers of the present day than to the Hookerian school of their own time. Still, many parts of their work need revision and the whole should be modernized and corrected in the light of recent discoveries and changes in nomenclature. Much might also be expected from a renewal of careful field work, especially in the eastern and western extremities of the archipelago which were not at all, or only slightly explored by Webb and Berthelot.

Fuerteventura and Lanzarote—the two most easterly islands—are rather more continental in vegetation than the others. Their original aspect can now hardly be imagined. Both are to-day absolutely destitute of forests. As Dr. Chil * says, "It is to be deplored that the first conquerors, as also the subsequent settlers of these islands, occupied themselves in destroying the woodland which there formed dense forests; their preservation would have been of immense benefit to the inhabitants who would not see, as they have for a long time been seeing, that the clouds seem to flee from their sky, and every ten years, at the least, the earth produces a half harvest, wherefore the people are obliged to migrate to the other islands or to the Americas, to secure a piece of bread."

---

* "Estudios de las Islas Canarias."

Not infrequently three or four years pass without rainfall on these arid shores, and one must needs have heroic enthusiasm to brave the heat and drought of the desert climate in the search for botanical novelties. On Lanzarote there are two insignificant, almost inaccessible springs. Fuerteventura is somewhat better provided and, "when the waters of heaven remember its inhabitants," is said to be "of wonderful fertility"—in a wet year producing more wheat than all the other islands together and of a very fine quality. Its vegetation is described as "exceedingly varied and of the greatest interest to the botanist"—"a miniature reproduction of the parts of northern, desert Africa." Lanzarote has been more torn by volcanic action than any of the other islands, and the character of the plants is distinctively Saharan. In one group of hills the soil is still so heated that wood will burn in the crevices. These two islands together have 32 species which are either confined to them or found only rarely on the other islands. Webb and Berthelot enumerate 165 species from Lanzarote, 43 from Fuerteventura. They spent only seven weeks on the former and a very few days on the latter and were in neither at the most favorable times of the year. Much might be expected from a thorough tour of their hills and valleys.

Canary and Tenerife, the two central and largest islands of the archipelago, are the ones to which our own study was confined. They have many features in common, rocky coasts reaching back into bleak, volcanic wastes and fertile inland cut into by numberless valleys and gorges and here and there boasting a wonderful piece of dense, luxuriant woods which the conquerors in some mysterious way overlooked in their wholesale destruction of the once all-dominating forests. There are distinctly marked floral regions and each is characterized by some remarkable development of plant life.

Over the barren coast wastes are scattered clumps of fleshy plants, prominent among them *Euphorbia balsamifera.* Its fruticose stems reach a height of four or five feet, branch copiously, forming a circular crown, and bear rosettes of leaves at the apices of the ramifications. The shrubby *Euphorbia aphylla* also abounds in the maritime regions. Among the cylindrical branches of both of these species wind the filiform stems of the curious *Linaria* *heterophylla* or the spiny-leaved, coriaceous *Rubia fruticosa*. The former species has been reported only from Lanzarote, but we found it abundant on the waste near Galdar. The latter is peculiar to the islands and grows in ravines and on hillsides as well as on the arid plains. The Rubiaceae are further represented by another species of *Rubia*, a species each of *Vaillantia* and *Sherardia*, and several *Galiums*—all known also from Europe; by *Phyllis nobla* L., a species peculiar to the islands which we have never seen; and by the remarkable shrub *Plocama pendula*, which with its slender drooping branches and leaves much resembles a diminutive weeping willow. It remains green and flowers on the dry hillsides when even the fleshy *Euphorbias* have lost their foliage and almost all the vegetable world seems dead. The bell-shaped flowers are waxy white—turning black, as does the whole plant, in drying—and appear to be dioeciously dimorphic, *i. e.*, the long- and short-styled blossoms are on separate plants.

Asparagus pastorianus is another example of drought resistance. We found its spiny branches covered with fragrant white flowers on a desert hillside in the middle of July of an unusually dry year.

Besides the *Euphorbias* mentioned above, the islands abound in other species. The fruticose forms occupy the place of the cacti of the American deserts. Six out of eight of these shrubby species are confined to the Canaries. Among them is the celebrated *Euphorbia* which the Guauches used, as do their descendants to-day, to poison the water left by the retreating tide in deep pools on the shore—hypnotizing the fish, which rise to the surface and are captured and freshened in unpoisoned water. Then there is also the strange *Euphorbia Canariensis* growing in clumps ten to twelve feet in diameter and sometimes twenty feet high, which is a most striking feature of the hillsides. The square or hexagonal cactus-like stems are about three inches in diameter and the clusters have been compared to immense candelabra. In addition to the woody forms there are eleven herbaceous species, all except one of which are known from the Mediterranean region. These are so different from the shrubby *Euphorbias* as to make one wish for a revision of the genus.

Another characteristic plant of the volcanic wastes is the leafless *Senecio spinosus*, which is as uncomfortable to handle as a sea urchin, and when the stems are broken, has a most disagreeable odor. It is very frequently half hidden in dense coils of *Cuscuta episonchum*, peculiar to the island, a humble relative of the beautiful shrubby Convolvulaceae which adorn the hillsides. Ten of the seventeen Convolvulaceae of the islands are not found elsewhere, and five of these peculiar species are fruticose.

Other Compositae of the tufa are species of *Chrysanthemum*, *Picris*, *Urospermum*, *Senecio*, etc. It seems worthy of remark that many of these, as of the other species of the desert lands, of whatever family (Euphorbiaceae, Compositae, Umbelliferae, Plumbaginaceae, Labiatae) grow in dense clumps, probably as a means of increased resistance to transpiration in addition to such other adaptations as fleshy or much reduced foliage, hoariness or coriaceous texture. The contrast between the shore *Senecios* and the fleshy *Senecio Kleinia*, which is common in the ravines, makes one question the present status of our systems of classification. The Compositae are altogether well represented by seventy five genera, including about sixty five peculiar species. *Eupatorium ageratoides*, not reported by Webb and Berthelot, is very common in the barrancos of Firgas and Tafira. Thistles of many genera are a conspicuous and beautiful feature in all sorts of localities.

The genus *Statice* has nine species, all peculiar to the islands, found in rocky and maritime localities and most of them very limited in distribution, *e. g.*, *S. papillata* is reported only from the little rocky islets Graciosa and Alegranza; *S. brassicaefolia* only from Gomera.

Even more highly differentiated is the Labiate genus *Micromeria*—represented by seventeen species, all but one peculiar to the Canaries and that one found elsewhere only on Madeira and Porto Santo. These plants grow in arid places among rocks and on hillsides everywhere—the shore forms assuming the characteristic dense clump growth. *Salvia Canariensis* is another interesting member of this family. It is widely spread on the islands and we have found, besides the ordinary merely hirsute form, another with densely white-woolly leaves which may be a distinct species and also a third form with pure white flowers instead of the usual pink-purple ones.

The Borraginaceae are greatly developed. The bright flowers of *Echium plantagineum* are a very familiar sight in all kinds of habitats. We once found among the ordinary deep-blue-flowered plants a single specimen bearing pure white blossoms. The giant spikes of the eleven fruticose species of the same genus—all peculiar to the archipelago—are conspicuous on the hillsides. Some of these are also decidedly local in their distribution. Dense mats of *Heliotropium erosum* cover large patches of dry, volcanic earth, while the sky-bright blossoms of *Myosotis* love the dampest places and the forest shade.

Another of our garden relatives, but again a peculiar species, is *Reseda scoparia*, which abounds on the volcanic wastes near Guia de Canaria, although we find it reported only from Tenerife and from the desert promontory at the northeast of Canary. Moreover, our garden "Nasturtium," *Tropaeolum majus*, not mentioned by Webb and Berthelot, grows profusely in damp places, evidently at home.

As one passes from the coast inland, he finds himself amongst a labyrinth of hills and mountains intersected by innumerable ravines or separated by broad valleys. Some of the hillsides are entirely covered with *Opuntia*, others are white with the flowers of *Cytisus* or *Retama*, others yellow with *Adenocarpus* or *Teline*, on others grow in profusion *Asphodelus*, *Gladiolus*, *Ferula*, *Andryala*, *Romulea*, etc., to the delight of the collector. The little native *Arisarum* springs from damp soil among the rocks as well as on the barren plains; rarely one meets with a small colony of *Habenaria* on the wet cliffs. Ferns abound. *Davallia Canariensis* roots on the bare rocks or on forest trees indiscriminately. *Adiantum Capillus-Veneris* is still more abundant; its delicate fronds grace every water-way or dripping cavern. *Trichomanes radicans* is found only in one locality, a dark gorge in the beautiful forest of Agua Garcia, in Tenerife, and another in Palma; *Asplenium palmatum* roofs damp caves, and hangs from the precipitous cliffs which bound narrow gorges, and *Adiantum reniforme*—which is found otherwise only in Madeira—grows in similar places. The fragrant little *Cheilanthes pulchella*, called by the English tourists the "hay-scented fern," hides in the crevices of stone walls. *Notholaena marantea* is not uncommon on dry hillsides. Two species of *Dryopteris* and several *Aspleniums* grow profusely in the forests. *Pteris aquilina* and *Polypodium vulgare* var. *serrata* are omnipresent. The latter is a very different plant from the *Polypodium* of our North American woods and perhaps merits specific rank.

There are many plants which have so adapted themselves to the rocky character of the soil that they prefer the chinks and crevices of the cliffs to what would appear to be more comfortable footing; as the aborigenes of the country chose rather to live in caves than in properly constructed houses which they understood well how to make. Conspicuous among such are the Crassulaceae which reach their greatest development on these islands. About sixty species are known from the Atlantic islands, but about thirty-eight of these are exclusively Canarian. They range in size from the tiny *Sedum rubens* and *Pterophyes brachycaulon*, 2 to 6 inches in height, to the giant *Sempervivums* 2 to 3 feet long, which somehow manage to suspend their great rosettes of heavy, fleshy leaves and dense flower clusters, from most inaccessible and barren-looking cliffs. These form also a picturesque element of the urban flora of such old towns as Laguna and Firgas where they grow on the red-tiled roofs in company with a great, golden-flowered *Senecio*.

But the richest of the island vegetation is found in the great forests which still remain to indicate the former beauty of the archipelago. There are about twenty strictly arboreal forest species. In the south-central part of Canary, one may ride for hours beneath the shade of the native pine (*Pinus Canariensis*)—a species said to have existed in Europe during the Tertiary period but now found only on the Canaries, its nearest living relatives being Mexican species. The extensive forests of Mercedes and Agua Garcia in Tenerife contain four magnificent Lauraceae, *Phoebe barbusana*, *Ocotea foetens*, *Laurus Canariensis* and *Persea Indica*. All occur also in Madeira and the two latter in the Azores. There are two tree heaths found also in Europe; two tree species of *Ilex*, one confined to the Canaries, the other found also in Madeira; the beautiful *Prunus lusitanica* and *Myrica faya*; *Arbutus Canariensis*, a peculiar species, whose golden fruits resemble miniature oranges; and *Visnea mocanera*, the mocan of the Canarians from which the aborigines fermented an intoxicating liquor. The European olive grows wild in groves with *Pistacia lentiscus*. The Canary willow and the indigenous *Phoenix dactylifera* are not infrequent in the beds of wet barrancos, while the native species of *Tamarix* and a *Juniperus*, now almost extinct, prefer the dry ones. Occasionally one sees on a precipitous wall a solitary specimen or a little group of the famous *Dracaena Draco* from which the "dragon's blood," so highly valued as a charm, medicine, and dyestuff, was obtained by the medievals. The herbaceous element of the forest flora is rich in peculiar species such as *Campanula Canariensis*, *Cedronella Canariensis*, *Senecio appendiculatus*, etc.

Other unique plants are found in the great craters. The perfect bowl of the Bandama crater of Canary, whose charred sides look as if they had been scorched only yesterday, but which has in reality been extinct since historic times, is the home of several species; so also is the ancient crater of Tiraxana on the same island. The immense crater of Palma is one of the most perfect in the world. The diameter of its base measures about six miles, and its walls are nearly seven thousand feet high. Its flora is of remarkable interest as it is one of the richest centers of peculiar species. The great peak of Tenerife itself is another hotbed of isolation; twenty-one species that exist nowhere else are found on it and on the great circle of the Cañadas which surrounds it. It is curious that several species are confined to this peak region and to the great Palma crater forty-five miles away (*e. g.*, *Senecio palmensis*)—and that others not identical are closely related, *e. g.*, in each there is a peculiar but related species of *Viola* not found elsewhere. The old Guauche idea that the peak was originally thrown out of the crater of Palma is the only explanation of this phenomenon which we have yet heard suggested.

Contributions from the Alabama Biological Survey.—I.

In January, 1897, the Alabama Biological Survey was formed by the voluntary association of those members of the faculty of the Alabama Polytechnic Institute, and of the Experiment Station, who were interested in biological subjects. Its object is the study of the flora and fauna of the State in all their relations, but with special reference to geographical distribution of species, and to the relation between the life zones thus established and the agricultural capabilities of these different regions.

The great part of the time of the members of the survey is necessarily given to other work, but a satisfactory beginning has been made, and considerable collections have been secured in all groups of plants and of the lower animals. Most of the field work has so far been done in the neighborhood of Auburn in Lee County, but trips have also been made to the northern and southern portions of the State.

Under the general heading of Contributions it is proposed to publish from time to time, in suitable periodicals, such results of interest as may be secured either by the members of the survey or by specialists to whom material is submitted. These Contributions will also be issued as serially-numbered reprints. The following two mycological papers constitute the first number of this series. Other papers on the spiders and on the myriapods of the State are in preparation.

1. NEW OR NOTEWORTHY ALABAMA FUNGI.

By F. S. Earle.

Micropeltis Alabamensis sp. nov.

Epiphyllous: perithecia 300–400 μ, scattered, convex, scutellate, orbicular, black, membranous, extending into a sterile border 100–200 μ wide consisting of agglutinated, branching, septate, guttate, fuliginous threads 3–5 μ in diameter; ostiolum conspicuous, depressed: asci numerous, irregularly clavate, stipitate, maturing in succession, 50–60 × 16–20 μ, spore-bearing part about 40 μ long: sporidia inordinate, about 6-septate, cylindrical, ends rounded, little or not constricted, 25–30 × 5 μ.

Following plant lice exudations on living leaves of *Magnolia Virginiana*, Auburn, Ala., April 11, 1896. Underwood & Earle. An undeveloped *Antennaria* occurs on the same leaves.

This is near *M. applanatus* Mont., but it seems to differ in the depressed ostiolum, the smaller asci and larger more frequently septate spores. Much confusion has resulted from the hasty and unwarranted reference of American material to foreign species. It seems better in every way to consider our species distinct until the contrary is clearly proven.

ANTHOSTOMELLA SPHAEROTHECA sp. nov.

Stroma thin, black, crust-like, containing 1–6 or 8, prominent, subconic perithecia, perithecial wall poorly developed, ostiolum very short-papillate: asci nearly orbicular, about 20 × 18 μ, aparaphysate, very thin and delicate, soon deliquescing and liberating the spores: sporidia oval or spindle-shaped, often inequilateral, ends acute, light fuliginous but transparent, the center usually occupied by a large oval vacuole, 16–18 × 5–6 μ.

On dead petioles of *Sabal Adansoni*, Tuskegee, Ala., Jan. 20, 1897. G. W. Carver (no. 101).

Externally this clearly resembles *A. minor* E. & M., but the asci in that species are cylindrical, and the spores only 7–8 μ long. The quickly evanescent asci are often hard to detect, a hasty examination giving the impression of a *Sphaeropsis*. The black, thin, crust-like stroma, and imperfectly developed perithecia suggest the Dothidiales, and it is possible that the species may ultimately be placed in *Auerswaldia*.

BOTRYOSPHAERIA ARUNDINARIAE sp. nov.

Stroma erumpent, pustular, bordered by the ruptured epidermis, small, usually about 1 mm., irregularly oval, black, stromatic material scanty: perithecia few, 2 or 3 to 6 or 8 in each stroma, soon partly exposed, black, carbonaceous, about 300 μ, with papilliform ostiolum: asci elongate, subcylindric, long-stipitate, 120 or more by 10–12 μ, paraphyses abundant, vague, minutely granular, 4–6 μ in diameter: sporidia subdistichous, continuous, hyaline, often granular and vacuolate, oval, often curved or inequilateral, ends acute, 20–25 × 6–8 μ.

On dead stems of *Arundinaria*, Tuskegee, Ala., Jan. 20, 1897. G. W. Carver (no. 110).

GNOMONIA SABALICOLA sp. nov.

Scattered or often gregarious, buried, but elevating the epidermis in grayish irregular blisters: perithecia depressed-globose, 300–400 μ; ostiolum black, long-exserted, slender, 500–700 μ: asci obtusely ovate, delicate and evanescent, about 70 × 20 μ, exceeded by the numerous, simple, thread-like, colorless paraphyses: sporidia 8, inordinate, uniseptate, obtuse, narrowly oval, cell contents honey yellow, with a thick, hyaline outer coating, 25–30 × 6–8 μ.

On dead petioles of *Sabal Adansoni*, Auburn, Ala., April 25 and July 9, 1896. Underwood & Earle.

This is sometimes accompanied by a *Sphaeropsis* with acute-ended spores measuring about 12 × 4 μ.

LEPTOSPHAERIA EUMORPHA (B. & C.) Earle.

Sphaeria eumorpha B. & C., Grev. **4**: 145.

Sphaeria arundinacea Rav. (not Sowerby) in Fung. Car. Exsic. **3**: 57.

Sphaerella eumorpha Cook, Jour. of Bot. 1873.

Didymella eumorpha Sacc. Syll. Fung. **1**: 560. Ellis & Ev. N. A. Pyr. 321.

Didymosphaeria eumorpha Atkinson, Bull. Cornell Univ. **3**: 6.

This abundant fungus presents such peculiar spore characters that it is not remarkable that its generic relationship has been misunderstood. When young the sporidia are hyaline, and are distinctly 3- or sometimes 5-septate. At maturity they become dark brown and densely opaque so that the septa are not visible. They are somewhat constricted at the middle septum, which gives the mature sporidium the effect of being only 2-celled as it has been always heretofore described. With careful illumination the additional septa can be seen after the spore has become quite darkly colored, but at full maturity they are completely obscured. In all other respects Atkinson's description is full and satisfactory. He is doubtless correct in referring our Alabama material as above, though Berkeley's remark (Grev. **4**: 145) that "There is another distinct species on *Arundinaria* from Alabama, but indescribable without sporidia," suggests the possibility of an error. Atkinson does not quote Massee's examination of the type except as to the color of the spores.

Ravenel, in Fung. Car. Exsic. **3**: 57, distributed a fungus on *Arundinaria* under the name of *Sphaeria arundinacea* Sow. In the copy that I have been able to examine, these specimens are identical with our Alabama material, and differ widely from European specimens of *Leptosphaeria arundinacea* (Sow.) Sacc. (See Thüm. Myc. Univ. 1256). Apparently the references to this as an American species in Sacc. Syll. Fung. **2**: 62, Ellis & Ev. N. A. Pyr. 371, and Farlow & Seymour Host Index 149, are all based on these South Carolina specimens, and if so this name should be dropped from lists of American fungi.

METASPHAERIA NIGROMACULANS sp. nov.

Forming blackened, irregularly oblong or elongated areas, 2–8 × 1–2 mm.: perithecia few, 1–6 in a spot, buried, thin-walled; ostiolum pustularly erumpent, 300–500 μ: asci 35–40 × 8 μ, thin-walled, clavate, short-stipitate, paraphyses thread-like, abundant: sporidia obliquely monostichous or inordinate, hyaline, yellowish at maturity, narrowly elliptical, ends subacute, 3-septate, 10–12 × 3–4 μ.

On dead stems of *Agave Virginica* Auburn, Ala., July 8, 1896. Underwood & Earle.

This differs from *M. Agaves* Roll. in the much smaller asci and spores, and in the spotting of the stem. The affected portion is bounded by a black circumscribing line within the stem.

PHYSALOSPORA PHILOPRINA (B. & C.) Sacc.

On *Ilex opaca*, Auburn, Ala., March 17, 1897. Earle & Baker.

This species was described (?) from North Carolina, Grev. **4**: 154, and it does not seem to have been since collected. Our specimen is determined with some doubt as the description is utterly insufficient for a proper identification. It affords the following characters:

Epiphyllous on large, dead, whitened, often apical areas, surrounded by a broad blackened border: perithecia buried, prominent, long covered by the whitened epidermis, under lens appearing dark with white center, rather small, 100–120 μ, epidermis at length cracking rimosely or stellately: asci oblong, about 40 × 8–9 μ: paraphyses thread-like, gelatinous, agglutinated: sporidia distichous or inordinate, narrowly oval, ends rounded, usually curved, guttate or coarsely granular, about 16 × 4 μ.

Sporonema Ilicis Earle, Bull. Torr. Bot. Club, **24**: 32, is probably a pycnidial form of this species.

TRICHOSPHAERIA UNDERWOODII sp. nov.

Perithecia black, superficial, collapsing, 300–400 μ, ostiolum obscurely papillate, surface abundantly clothed with dark brown, continuous or sparingly septate, rigid but flexed hairs 100–300 × 3 : perithecia seated on a thin, dark brown mycelium consisting of scattered, interlacing, frequently septate threads, each cell of which has a conspicuous vacuole; rising from the mycelium are frequent, erect, rigid, septate setae 150–200 μ long by 5–6 μ at base and tapering upward to a point: asci cylindrical, 80–100 × 8 μ, paraphyses vague and indistinct, slender, branching: sporidia 8, monostichous, oblong to narrowly oval, ends rounded, at length distinctly uniseptate and yellowish, about 20 × 4 μ.

On dead stems of *Arundinaria*, Auburn, Ala., January 4, 1896. Underwood & Earle.

This differs from the description of *T. Arundinariae* E. & E., from Louisiana, in its collapsing perithecia which at first glance make it seem almost pezizoid, and in the smaller, uniseptate spores with rounded, not acute ends.

VALSARIA NUDICOLLIS (B. & C.) Sacc.

On the hardened outer surface of rotten pine wood, Auburn, Ala., March 21, 1896. L. M. Underwood.

This seems to be the first time that this interesting species has been taken since the type collection in South Carolina. Berkeley's description (Grev. **4**: 93) of the connate umber-brown perithecia with black ostiola forming an almost continuous crust fits our specimen so exactly that there seems no doubt of the determination. The following additional characters are noted:

Stroma reduced to a thin umber-brown coating: perithecia erumpent, crowded, forming a crust-like covering over considerable areas, or scattered in small groups, long partially covered by the whitened ruptured fibers of the surface wood, globose, 350–500 μ; ostiolum prominent, black, shining: asci cylindrical, spore-bearing part about 60 × 6–7 μ, paraphyses numerous, flat, twisted, about 80 × 4–5 μ: sporidia 8, obliquely monostichous, regularly oblong-oval, ends obtuse, brown, equally uniseptate, about 10 × 5 μ.

HYPOMYCES AURANTIUS (Pers.) Fckl.

In Ala. Exp. Sta. Bull. **80**: 185 this species is credited to

Alabama from the specimen on *Cantherellus aurantiacus* collected by Judge Peters and distributed in Rav. Fung. Car. Exsic. **5**: 64 under that name. A recent examination of these specimens shows that they were wrongly determined. They are evidently only a form of *H. lactifluorum* (Schw.) Tul., which is exceedingly common throughout this region.

H. aurantius does however occur in this State. Fine specimens on *Polyporus resinosus* were collected at Auburn, February 22, 1896, by Underwood & Earle. These agree perfectly with Thüm. Myc. Univ. 1747 and with published descriptions. They are abundantly accompanied by the conidial form, *Diplocladium minus* Bon.

NECTRIA EPISPHAERIA (Tode) Fr.

This is a very abundant fungus in Alabama, occuring on various species of *Nummularia*, *Valsa*, *Ditrypella*, etc. From its abundance and the ease with which it adapts itself to different hosts we should expect it to be variable in its characters. The spores are described as unequally uniseptate and constricted. Quite as often they will be found to be equally uniseptate and not at all constricted, and in vigorous specimens it is not very unusual to find spores that are 2- or even 3-septate. The perithecium too, while normally smooth and greatly collapsed, is sometimes little or not at all collapsed and covered with a thin tuft of delicate, branching, anastomosing, appressed, orange-red hairs. These are about 3 μ in diameter and an occasional free end projects 8–12 μ beyond the perithecium. It is possible that the examination of a sufficiently large series of specimens would show that more than one species is confused under this name, but from present observations the characters tend to merge into each other so that it is impossible to separate the forms.

NECTRIA (EUNECTRIA) MELIAE sp. nov.

Cespitose, 3 or 4 to 12 or 16 on a prominent dark brown or blackish stroma .5–1 mm. in diameter by .5 mm. high: perithecia 300–400 μ, dingy red, becoming dark brown with age, usually collapsing, surface marked with blunt subconic tubercles, not hairy: asci about 70–80 × 8–10 μ: sporidia monostichous, slightly yellowish, ends subacute, 16–18 × 4–6 μ: conidia abundant on the young stroma, about 6 × 1 μ, little or not at all curved.

On dead twigs of *Melia Azedarach*, Auburn, Ala., March 13 1896. Underwood & Earle.

This is somewhat nearly related to *Nectria cinnabarina* (Tode) Fr., but it differs from Swedish specimens of that species collected by Fries and now in the Peters Coll. in its smaller and darker perithecia, and in the smaller, darker and much more prominent stroma.

N. verrucosa (Schw.) Sacc. is said to occur on *Melia* in South Carolina. Our specimens agree well with this in the peculia, roughening of the perithecia, and in the size and general appearance of the spores. The stroma is, however, entirely different, being vermilion red and flat or concave in that species, but dark brown and prominently wart-like in this one. The specimens of *N. verrucosa* that I have been able to examine were none of them on *Melia* but probably all on *Morus*.

AULOGRAPHUM CONFLUENS sp. nov.

On blackened areas: perithecia gregarious, black, slender, flexed and variously confluent, fragile, composed of loosely joined parallel threads, 400–800 × 40 μ, lips rather lax and open: asci oblong, very numerous, about 25–30 × 4–5 μ, paraphyses thread-like, enlarged above, much agglutinated and often indistinguishable: sporidia distichous or inordinate, oblong, ends obtusely rounded, nearly equally uniseptate, constricted, hyaline, about 6 × 3 μ.

On dead weathered stems of blackberry (*Rubus* sp.), Auburn, Ala., February 1, 1896. Underwood & Earle.

In extreme cases the patches of confluent perithecia remind one of *Glonium stellatum* in miniature. *Lophodermium rubiicolum* also occurs on the same canes.

LOPHODERMIUM RUBIICOLUM sp. nov.

Perithecia thickly scattered, sometimes crowded and occasionally confluent end to end, 1–2 × .25 mm., strongly convex and prominent, almost seeming superficial, dull black, straight or flexed, ends obtuse, lips prominent and somewhat widely opened: asci narrowly linear, about 60–70 × 4 μ: spores nearly equaling the ascus, light yellow, twisted, exceedingly slender, scarcely .75 μ in diameter.

On dead blackberry stems (*Rubus* sp.), Auburn, Ala. February and March, 1896. Underwood & Earle.

The prominent perithecia give this at first sight the look of an *Hysterium* rather than that of a *Lophodermium*. In the numerous specimens examined the asci were all in rather poor condition and the spore characters were difficult to make out. The paraphyses, if present, were so agglutinated as to be indistinguishable.

Cercospora gnaphaliacea Cooke (?).

Spots none: hyphae collected in dense fascicles arising from a stromatic base, fascicles thickly scattered over considerable areas which they discolor, hyphae long, weak and flexed, but sparingly or not at all dentate, occasionally septate, in the dried specimens seemingly flattened and twisted, olivaceous, 100–200 or more by 4–5 : conidia, straight, cylindrical, 3-septate, granular, hyaline, about 40–50 × 5–6 μ.

On *Gnaphalium purpureum*, Auburn, Ala., February 21, 1897. Earle & Baker.

This is a peculiar species and it departs quite widely from the usual type of the genus. In general appearance it somewhat resembles *Scolecotrichum Euphorbiae* Tracy & Earle, on *Euphorbia*.

It is impossible to decide from Cooke's brief description whether or not this is the same as the Texas fungus collected by Ravenel. As the probabilities seem to lie in that direction it is provisionally so determined.

Cercospora omphacodes Ell. & Holw.

On *Phlox maculata* Chambers County, Alabama, June 22, 1897. F. S. Earle.

Our specimens show no distinct spotting of the leaves such as is found in Canadian specimens on *Phlox divaricata*, N. A. F. 2975, and Louisiana specimens on *P. paniculata*, Langlois, no. 1365. The hyphae are hypophyllous and effused over considerable areas forming a cinnamon-brown coating. The leaf is only slightly discolored above. The spores and hyphae are much as in the other specimens mentioned, though the latter are perhaps less closely fascicled, and somewhat longer in the Alabama form. It should be noted that these specimens were taken in deep shady woods.

Cercospora Ribis sp. nov.

Spots definite, orbicular or irregular, 1–3 or 4 mm., white above, brown below, with dark brown narrow border: hyphae hypophyllous, loosely fascicled, dark fuscous, long and slender, multiseptate, flexed and denticulate for the greater part of their length, 150–200 × 3–4 μ: conidia hyaline, long, slender, curved, clavate, tapering from 3–4 μ at the obtuse larger end to 1–2 μ at the smaller end, at first continuous, then multiseptate, 100–200 μ long.

On leaves of cultivated gooseberry (*Ribes* sp.), Auburn, Ala., July 18, 1896.

This conspicuous and well-marked species attacks the gooseberry foliage abundantly, causing it to fall prematurely. It is probably one of the causes for the failure of this fruit in this region.

PHYLLOSTICTA ARIDA sp. nov.

Spots orbicular or somewhat irregular, 3–6 mm., white, arid, with a narrow inconspicuous yellowish brown border: perithecia black, scattered, prominent on both sides of the leaf, 80–100 μ; sporules obtusely oval to ovate, thick-walled, contents granular, 8–10 × 6–7 μ.

On *Acer Negundo*, Auburn, Ala., June 5, 1897. Earle & Baker.

On some of the spots occurs also a *Discosia* with curved 3-septate spores about 12–14 × 3 μ, with a delicate seta attached near, but not at, each end.

PHYLLOSTICTA MACROGUTTATA sp. nov.

Spots orbicular, brown, sometimes becoming whitish, with a broad darker brown border, 1–2 mm., abundant, but usually not confluent: perithecia epiphyllous, few, 1–6 or 8 on each spot, black, prominent, about 80 μ: sporules elliptical, 6–7 × 5 μ, usually with a large conspicuous spherical vacuole 3.5–4 μ in diameter.

On *Meibomia* sp. Auburn, Ala., June 28, 1891. Atkinson. On *Meibomia Dillenii*, August 11, 1897. Earle & Baker.

The Atkinson specimen in this herbarium was labeled *P. Desmodii* E. & E. (?). On this authority this name was included in Prel. List Ala. Fungi, Exp. Sta. Bull. **80**: 167. It is also given from the same collection in Cornell Univ. Bull. **3**: 31. *P. Desmodii* is described with spores only 3.5 × 1.5 μ, which differs so widely from the large conspicuously guttate spores uniformly found in the Alabama specimens that I must consider ours to be distinct. The spots, too, in our specimens are much smaller and are seldom or never confluent. This being so, *P. Desmodii* should be dropped from the list of Alabama fungi.

SEPTORIA.

On *Silene Virginica*, Auburn, Ala., May 29, 1897. Earle & Baker.

Spots pallid, irregular, 2–8 mm., sometimes confluent, with an indistinct brownish border: perithecia scattered, abundant, black, thin-walled, with a large ostiolum, about 80 μ: sporules cylindrical, straight or bent, ends rounded, continuous or at length uniseptate, 20–30 × 3 μ.

This seems to differ from *S. silenicola* Sacc. (*S. Silenes* E. & M.), and *S. noctiflora* E. & K. in the darker perithecia and somewhat shorter and broader spores. Unfortunately the N. A. F. specimens of both these species to which I have access are sterile. The spotting of the leaves in both agrees quite closely with that produced by our fungus. The description of *S. dimera* Sacc. indicates that it is very near our form, but it is not recorded from this country and I have seen no specimens. It does not seem advisable to propose a new name for this form until it can be compared with good specimens of the three above-mentioned species.

2. NEW SPECIES OF ALABAMA FUNGI.

BY CHAS. H. PECK.

LEPIOTA LONGISTRIATA.

Pileus thin, convex or nearly plane, umbonate, hairy-squamulose, striate nearly or quite to the umbo, whitish or pale gray, brownish on the umbo; lamellae narrow, close, free, minutely floccose on the edge, yellowish white, becoming darker in drying; stem slender, hollow, tapering upward from a thickened base, the annulus delicate, evanescent; spores elliptical, 6–7.5 μ long, 4–5 μ broad.

Pileus 2.5–5 cm. broad; 5–7.5 cm. long, 2–6 mm. thick.

In gardens. July. F. S. Earle.

LEPIOTA EARLEI.

Pileus thin, broadly convex or nearly plane, umbonate, adorned with minute scurfy brown scales and whitish hairs, the margin striate and somewhat lacerate, whitish; the umbo glabrous, brown; lamellae numerous, thin, close, subventricose, free, white; stem slender, fibrous, hollow, tapering upward, enlarged at the base, the flesh changing to reddish where wounded; spores elliptical, 10–12.5 μ long, 6–7.5 μ broad.

Pileus 5–7.5 cm. broad; stem 5–7.5 cm. long, 4–6 mm. thick.

Newly cleared land; cespitose. August. Earle. "A very pretty and delicate species." It is smaller than *L. Americana* and has larger spores. The change in color is limited to wounded places.

LACTARIUS SALMONEUS.

Pileus rather thin, convex, becoming nearly plane or slightly depressed in the center, dry, subvelvety, sometimes irregular, white, becoming reddish where bruised; milk bright salmon color, taste mild, slightly aromatic; lamellae narrow, close, adnate or decurrent, bright salmon color; stem short, solid, central or occasionally eccentric, velvety, white, salmon color within; spores subglobose, 7.5–9 μ long.

Pileus 2.5–3.8 cm. broad; stem about 2.5 cm. long, 3–6 mm. thick.

Cespitose, in wet swampy places, usually on naked ground that has been overflowed. August. Earle & Baker.

A small but very distinct species easily recognized by the salmon color of the milk, and the change in the color of the bruised flesh.

LACTARIUS SUBVELLEREUS.

Pileus fleshy, firm, broadly umbilicate or centrally depressed, becoming somewhat infundibuliform, downy-tomentose, white, often with yellowish stains or becoming yellowish or tawny-yellow with age, the margin at first strongly involute, milk abundant, pale creamy-yellow, taste very acrid; lamellae narrow, crowded, often forked, adnate or slightly decurrent, pale creamy yellow, becoming tawny where wounded; stem short, equal or tapering downward, solid, white, downy; spores subglobose, about 7.5 μ long

Pileus 7.5–15 cm. broad; stem 1.8–4.8 cm. long, 1.2–2.5 cm. thick.

Dry ground in mixed woods. August. Earle.

The species is similar to *L. vellereus* in the soft downy or velvety coating of the pileus and stem, but differs from it in the narrow crowded lamellae and the color of the milk. This last character and the downy surface of the pileus and stem separate it from *L. piperatus*. It appears to combine the characters of these two species. The acrid taste persists in the mouth a long time.

RUSSULA POLYPHYLLA.

Pileus convex and centrally depressed or subinfundibuliform, glabrous, somewhat areolate, pale flesh color, odor strong, taste mild; lamellae numerous, narrow, close, adnate or subdecurrent, dingy flesh color; stem equal, hollow, colored like the pileus; spores subglobose, about 7.5 μ long, 6–7.5 μ broad.

Pileus 7.5–12.5 cm. broad; stem 5–7.5 cm. long, 1.2–2.5 cm. thick.

Woods. July. Earle.

RUSSULA ALBIDULA.

Pileus broadly convex or nearly plane, glabrous, white, even on the margin, flesh white, taste acrid; lamellae moderately close, adnate or slightly decurrent, some of them forked at or near the stem, white, the interspaces venose; stem equal, even, solid, white; spores subglobose, 7.5–10 μ long, 6–7.5 μ broad.

Pileus 2.5–5 cm. broad; stem 2.5–3.8 cm. long, 8–12 mm. thick.

Pine woods. November. Earle.

The whole plant is white when fresh, but in dried specimens the pileus and lamellae are sometimes tinged with yellow. The species may be separated from *R. lactea* by its acrid taste, from *R. virginea* by its acrid taste and larger spores and from *R. anomala* by the even margin of the pileus.

OMPHALIA EXIMIA.

Pileus thin, infundibuliform or deeply umbilicate, glabrous, white, becoming grayish-white in drying, the thin margin spreading or deflexed; lamellae rather narrow, subdistant, very decurrent, white; stem slender, equal or slightly enlarged above, glabrous, hollow, white; spores subglobose, 4–5 μ broad.

Pileus 1.2–3.2 cm. broad; stem 2 5–5 cm. long, 2–3 mm. thick.

Decaying wood. July. Earle.

The species appears to be related to *O. euomphalos*. In that species the pileus in the dried specimens is said to be brownish-red. In this, the pileus and stem are grayish white and the lamellae are dingy ochraceous-buff.

PANUS NIGRIFOLIUS.

Pileus 1–2 cm. broad, thin, dimidiate, sessile, dry, pulverulent or minutely subtomentose, at length distantly striate, rufescent; lamellae distant, unequal, blackish-brown.

On alder. July. Earle.

From *P. operculatus*, which also grows on alder, this species may be separated by the soft pulverulent coating of the pileus, by the lateral attachment of the pileus and by the very dark or almost black color of the lamellae. Spores not seen.

BOLETUS LEPTOCEPHALUS.

Pileus thin, broadly convex or nearly plane, dry, minutely rimose, especially near the margin, light tawny-brown, sometimes tinged with reddish-brown, flesh yellowish-white, taste at first mild, then slightly acrid; tubes subventricose, depressed about the stem, nearly free, dingy olive-yellow, the mouths small, subrotund; stem nearly equal, enlarged at the top, solid, glabrous or slightly pruinose-mealy, reticulated above, colored like the pileus, white within, with a white mycelium at the base; spores greenish-olivaceous, fusiform, 12.5–17.5 μ long, 5–6 μ broad.

Pileus 10–12.5 cm. broad; stem 10–12.5 cm. long, 1.2–1.6 cm. thick.

Dry, open woods. July. Earle.

The reticulation of the upper part of the stem appears to be formed by the decurrent walls of the tubes. The species belongs to the tribe *Edules*.

THELEPHORA GRACILIS.

Stems scattered, branched above, slender, tough, the branches slender, subterete, sometimes slightly channeled on one side, once or twice forked, the tips acute, becoming brownish with age, the stem and branches whitish; spores oblong, 12.5–15 μ long, 4–5 μ broad.

Plant 3.7–5 cm. high, stem about 2 mm. thick.

Moist ground. July. Earle.

The species is related to *T. Schweinitzii*, from which it differs in habit, in its slender and nearly terete branches and in its spores.

CLAVARIA LONGICAULIS.

Stem slender, solid, sparingly and irregularly branched above, the branches rather long, simple or sparingly branched, the tips blunt, the whole plant dark brown when fresh, externally dark ochraceous when dry, longitudinally and somewhat irregularly wrinkled; spores ochraceous, ovate or subelliptical, minutely roughened or echinulate, 6–7.5 μ long, 4–5 μ broad

Plant 3.7–5 cm. high; stem about 2.5 cm. long, –2.4 mm. thick.

Moist ground. July. Earle.

A well-marked and peculiar species readily known by its long stem, uniform dark brown color fading externally in the dry plant to ochraceous and by the longitudinally wrinkled stem and branches.

New Plants from Wyoming.—III.

By Aven Nelson.

ARABIS BREBNERIANA.

Perennial, the strong vertical taproot surmounted by a short crown, stems single (sometimes 1 or 2 small accessory ones divergent from the base); main stem excurrent, the few slender branches paniculate, canescent: basal leaves rosulate, entire or obscurely dentate, oblong to oblanceolate, 2–3 cm. long, whitish with a dense branched pubescence, petioles short or margined; cauline leaves auriculate-clasping, dentate, oblong, obtuse, 2–3 cm. long, less densely pubescent than the basal leaves: raceme paniculate, leafy-bracteate below, bractless above, pubescence becoming sparser upwards, almost absent on pedicels and altogether on the pods: flowers very small: sepals greenish, sparsely hirsute, thin, veiny, oblong, obtuse, about 3 mm. long: petals white, broadly spatulate with a narrow claw, about 4 mm. long: pods erect, nearly cylindrical, 2–3 cm. long, less than 2 mm. in diameter; the suture of the valves distinct; valves obscurely few-nerved; fruiting pedicels divaricate-ascending, 5–10 mm. long: seeds in two rows, numerous, crowded, ovate or elliptic, wingless.

I dedicate this to Miss Margaret Brebner who first collected this rare species near Laramie, June 6, 1897. It was secured by the writer at Fort Steele, on the Platte during the same month, but in both localities it seems to be a very rare and scattering plant. It occurs on grassy slopes and bottom lands the soils of which are slightly saline.

Type specimen in Herb. Univ. of Wyoming, no. 3135.

VICIA CAESPITOSA.

Perennial from slender matted rootstocks; stems numerous, spreading, striate, loosely and crisped hairy, 6–12 cm. long, forming dense mat-like patches 1 m. or more across: leaflets 3–5 pairs, pubescent, sparsely so above, more closely below with short, loose and crisped hairs, nearly sessile, oblong, subcuneate at base, the obtuse apex apiculate, quite constant in shape, 10–15 mm. long, 3–4 mm. wide, firm in texture, conspicuously veined; stipules half sagittate, the acuminate apex incurved, the short base usually curved and rarely dentate; peduncles equaling or exceeding the leaves, 2–5-flowered (usually 3 or 4): flowers blue or purplish, large for the plant, about 20 mm. long: style abruptly bent: pod exsert-stipitate, both margins curved or doubly curved, about 30 mm. long or probably at maturity longer.

This plant was found growing in abundance on an alkaline, gravelly-clay slope, almost devoid of other vegetation. Its nearest ally is *V. lineans* (Nutt.) Greene, but its habit, size and leaf character are so different that, seen growing, it hardly suggests such affinity.

Type specimen in Herb. Univ. of Wyoming, no. 2949, Laramie Plains, June 12, 1897.

PHILADELPHUS OCCIDENTALIS.

A shrub growing in dense clumps or sometimes as scattering individual specimens, .5–1 m. or more high, divaricately and somewhat rigidly branched; the older stems glabrous with grayish shreddy bark; the younger stems brownish, finely appressed-hirsute; the younger divaricate twigs appearing rigid or thorn-like, 5–12 cm. long, bearing 2–5 pairs of leaves and terminated by a 3-flowered cyme: leaves oblong to ovate, acute, 3-nerved from the rounded base, very short-petioled, appressed short-hirsute, sparsely so above, 10–18 mm. long: peduncles 3–4 mm. long, densely white-hirsute as is also the base of the calyx: sepals ovate, acute, hirsute on both faces, 5–6 mm. long: petals white, broadly obovate, obscurely dentate around the summit, when fully developed 10–12 mm. long: stamens about 60: filaments slightly unequal, 4–6 mm. long: styles four, free for from one-third to one-half their length, about 4 mm. long.

Specimens by J. E. Bodin from Cañon City, Colorado, collected in 1890 and by Geo. E. Osterhout from Glenwood Springs, Colorado, in 1895 are of this species but were distributed as *P. microphyllus* Gray. That species is undoubtedly the nearest ally and it seems probable that much that has passed for that will prove to be the species now proposed. I have not seen the type specimens of Dr. Gray's species nor authentic ones from type locality but it is certain that these northern specimens do not accord with the description of the original southern ones. The description leads one to think that the two differ strikingly in habit, pubescence of leaf and calyx and especially in the number and structure of the essential organs of the flower.

Seemingly very rare; observed in but one locality, a dry, stony cañon near Rock Springs. Collected first by the writer, but the excellent specimens, which are taken as the type, were secured by Robert Smith, Jr., from the same locality July 25, 1897, no. 3595.

ANGELICA AMPLA.

Perennial, glabrous, stout, main stem often 5–7 cm. in diameter at the base, freely branched above, giving to the plant a large hemispherical head, 1.75–2.25 m. high; stems and branches purplish: leaves large, the lower (including the long petiole) from .75–1 m. in length, twice-pinnate, *i. e.*, the leaf is divided into 5–7 leaflets each of which is again pinnately divided into 3–7 parts which may be sessile or petiolulate, and simple or 2–3-cleft or parted; the upper leaves correspondingly smaller and inclined to be ternate-quinate; the dilated sheathing base of the petioles ample, 1–3 dm. long; leaflets ovate, obovate or broadly elliptic, 5–25 cm. long, acute or short-acuminate, irregularly serrate, the serrations cuspidate-pointed: peduncles axillary and terminal, elongated; rays numerous, 40–50, stout in fruit, 6–10 cm. long, glabrous or closely puberulent; pedicels very numerous, 10–12 mm. long: involucre and involucels none: flowers white: fruit oblong, 5 mm. long, 4 mm. broad, wings narrow, about one-sixth the total breadth of the seed, of medium thickness, slightly thickened on edges; dorsal and intermediate ribs nearly similar, rather thin, not conspicuous: oil tubes small, contiguous, numerous, about 12 on the dorsal side and about 8 on the commissure: seed concave on the face.

A striking plant of rare occurrence; it loves stream banks where the isolated individuals occur in the openings among the willows. It was first collected in 1896 on Sand Creek, near the Colorado line, the specimens being distributed as *A. Lyallii* Wats., under no. 2046. Collected again in 1897 on the Laramie River, near Jelm mountain, no. 3460.

Though first supposed to be *A. Lyallii*, it differs from that in its greater size, the longer rays of the umbel and especially in the narrowly winged carpels, the numerous small oil tubes and the concave face of the seeds. In *A. Lyallii* the wings are as broad as the body of the seed, the oil tubes large and only one in the intervals, the face of the seed plane or convex.

It may be further pointed out that all the stations from which

A. Lyallii has been reported are in the northwest, Yellowstone Park being the most southeastern of the points, while these specimens are from the extreme southern part of Wyoming.

Probably in general appearance, as well as in fruit characters, it is more nearly allied to *A. atropurpurea* L., though good diagnostic characters separate it equally well from that.

Type material, no. 2046, collections of 1896 and no. 3460 of 1897, the latter supplying mature fruit.

OONOPSIS WARDI (Gray) Greene.

Aplopappus Fremonti Wardi Gray.

Of this plant there seem to have been no collections since the type material was secured by Mr. L. F. Ward somewhere in Wyming, "probably in the southwestern part." Whether that was the original locality may always remain in doubt, but certain it is that no exact duplicates have yet been secured.

A plant collected by the writer on the Laramie Plains, first in 1895 and again in 1896 and in 1897, is probably the nearest approach to it that has been secured. This differs so much that it is not wise to send it out as representative of the type, though specimens of it have been distributed under my numbers 1553 and 2792, as *A. Fremonti* near var. *Wardi* Gray. Now that Ward's specimens have most properly been constituted a species, the Laramie Plains specimens may receive a varietal name and may be characterized as follows:*

OONOPSIS WARDI CONDENSATA.

Perennial from horizontal rootstocks on which are borne numerous simple or branched, vertical caudices from the summits of which arise the annual herbaceous stems; stems spreading, mostly simple as to their bases, freely and fasciculately branched toward the summit, 1.5–2.5 dm. long, very leafy, especially upwards: leaves glabrous, broadly linear to narrowly oblanceolate, 1-nerved or often 3-nerved at base, acute, sessile or tapering gradually into a margined base, 6–12 cm. long: inflorescence of the tufted plant as a whole dense, from rounded to almost flat-topped; inflorescence of the branchlets a close glomerule of about 3 heads, often overtopped by the upper leaves: head rayless, 15–25-flowered, 10–15 mm. high: involucral bracts lanceolate-acuminate, nearly equaling the flowers: achenes striate, flattened-clavate, glabrous, when mature 6 mm. long; pappus scanty, about equaling the achene.

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* The available description of the type is so meager that it seems well to do more than merely point out the differences of the variety.

It is abundant in a few localities on the Laramie Plains, inhabiting gravelly-clay soil of some ridges and flats. Last collection of it and type of the variety, no. 3459.

CHRYSOTHAMNUS GLAUCUS.

A slender, sparingly branched shrub, .5–1 m. high; the older branches naked, gray with a shreddy bark; the season's twigs somewhat fastigiate, leafy, glabrous with whitish shiny bark: leaves suberect, narrowly lanceolate, acute, obscurely 3-nerved, 2.5–4 cm. long, usually once or twice twisted half way round, glaucous, *i. e.*, varying from whitish to a bluish green hue with an ill-defined sheen, margins obscurely scabro-ciliate: heads numerous, in short, compact, terminal, rounded cymose corymbs, about 8 mm. high, bracts subcarinate, 5-ranked, 3–4 in each rank, lanceolate, acute, the outer greenish, the inner thin, membranous, all erect or somewhat loose in age, glabrous as is the whole inflorescence except for a minute pubescence on the pedicels: corollas 4 (seemingly invariably so), lobes linear-lanceolate, about half the length of the tube: style tips linear-subulate, tardily exserted: achenes silky, short-linear or slightly enlarged upward, half as long as the rather rigid abundant pappus.

Not readily referred for comparison to any of the existing species but having a few of the characters of both *C. elegans* Greene and *C. viscidiflorus lanceolatus* (Nutt.) Greene, from both of which it is too distinct to allow of serious comparison.*

Seemingly very rare; on dry slopes in the foothills of the Medicine Bow mountains, Chimney Rock, Aug. 8, 1896, no. 2054.

SOLIDAGO CONCINNA.

Densely tufted from branching, horizontal, or ascending rootstocks, bright green and glabrous throughout, 15–25 cm. high; stems numerous, simple except as to the floriferous summits, densely leafy up to and including the basal part of the glomerate inflorescence: root-leaves narrowly oblanceolate, tapering very gradually and margined the whole length of the slender base, 8–15 cm. long; stem leaves narrowly oblong or oblanceolate, diminishing in size upward, those of the inflorescence becoming small and linear; all the leaves obscurely scabro-ciliate on the margins, usually a few of them showing slight serrations, triple-nerved, but the lateral ones often incomplete or obscure: heads about 5 mm. high, very numerous, closely fastigiate-glomerate: bracts of the involucre oblong, subacute or obtuse, thin-margined, greenish down the middle: rays small, 5–9: disk-flowers 10–15: achene cylindrical, pubescent, obscurely nerved, more than half the length of the pappus.

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* Dr. Rydberg, who has kindly made comparison of the plants published in this third paper, informs me that *Bigelovia Douglasii ciliata* of Palmer's collection of 1896 is the same, but there seems to be no description of it.

Its affinities are not clear, but it is probably nearest to the *S. Missouriensis* group. It is sub-alpine in habitat, occupying abrupt slopes in partly wooded stations.

Type specimen in Herb. Univ. of Wyoming, no. 2632, Lake Creek, Medicine Bow Mountains, August 13, 1896. Also from Dome Lake, Big Horn Mountains, July 17, 1896, no. 2381.

SOLIDAGO DIFFUSA.

Perennial from a tufted mass of rootstocks, diffusely spreading, the whole forming a rounded mass of golden yellow 1 m. or more across; closely cinereous-puberulent throughout except as to the heads; stems very numerous, virgate, 6–8 dm. long, striate, floriferous for nearly one-half their length; lower stem leaves very narrowly oblanceolate, obscurely 3-nerved, entire, 6–12 cm. long: leaves gradually reduced in size upward on the stem; upper leaves oblong, those of the long, virgate, secund inflorescence regularly reduced but leaf-like except at the summit where they become mere bracts: panicle narrow, racemose, 2–4 dm. long, its short crowded branches scorpioid: heads about 6 mm. high: bracts of the involucre oblong-elliptic, obtuse, glabrous, greenish with thin colorless margins: rays usually 5, small spatulate: disk-flowers 10 or fewer: achene closely puberulent, cylindrical.

It is seemingly quite local as nothing approaching it has been secured in several years' collecting in the state.* A number of very fine clumps of it were observed in the eastern end of the cañon of the Platte where that stream finds it way through the Laramie Hills range. Badger, August 27, 1896, no. 2761. Type specimen in Herb. Univ. of Wyoming.

PICRADENIA LIGULAEFLORA.

Hymenopappus ligulaeflorus A. Nelson., First Rep. Fl. Wyo. 135. May, 1896.

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* Dr. Rydberg suggests that this is the *S. nemoralis* of most of the Western Reports and states that its range extends from Kansas to the Saskatchewan. It is so very different from the eastern *S. nemoralis* that I had not associated the two at all.

Picradenia pumila Greene, Pitt. **3**: 271. Feb. 1898.

Recently in rehabilitating Sir Wm. Hooker's genus *Picradenia*, Dr. Greene published, among others, as new, *P. pumila*. This it seems is the same as my *Hymenopappus ligulaeflorus*, so this specific name will have to stand, though, now that the plant is transferred from a rayless genus to one in which ray-flowers are normal, this name no longer has any special significance. My original specimens of this were distributed to several under no. 1573 or 1603.

SENECIO SCAPOSUS. = S. [illegible]

Perennial from a multicipital caudex, cespitose in habit or surculose-spreading, forming large mats; stems very numerous, simple, one (sometimes 2 or 3) from each prostrate-assurgent crown of the caudex, scapose, 1–2 dm. high, tardily glabrate: leaves crowded on the crowns of the caudex and at the base of the scapose stems, of two forms, the larger from narrowly elliptic to oblong, 2–4 cm. long, obtuse or acute or, more rarely, 3-toothed, the middle tooth much the largest (with this removed such a leaf is truncate), tapering into a petiole as long as the blade or longer, nearly glabrous at flowering, the midrib plainly discernible and a pair of lateral veins obscurely so; the smaller leaves tomentose, interspersed bract-like among the larger ones, oblanceolate to spatulate, rarely 3-toothed at the apex; bract-like leaves of the scape small, linear from a broad tomentose base; heads several (3–8 or rarely only 1 or 2), cymose-corymbose, the terminal one overtopped by most of the others, 9–12 mm. high: involucre obscurely or not at all calyculate, bracts linear-lanceolate, slightly scarious on the margins: rays 5–9, oblong-elliptic, 5–7 mm. long, golden yellow: achenes seemingly glabrous.

The species that it most nearly approaches is *S. petrophilus* Greene from which it differs in its larger size throughout, its decidedly scapose aspect and its very cespitose habit; this belongs to the foothills; that is alpine in habitat, in sheltered, rocky cañons where it is seemingly a rare plant.

Laramie Hills, June 6, 1896. Type specimen in Herb. Univ. of Wyoming, no. 1908.

PENTSTEMON RIPARIUS.

The numerous stems (5–25) arising from a woody rootstock, this sometimes an inch or two in diameter at the crown; stems stout, spreading in all directions, prostrate-assurgent, 24 dm. long, simple or nearly so, puberulent even when mature: leaves with a glaucous hue, puberulent or often so only on the margins, both leaves of the pair ascending on the upper side of the prostrate stem, causing it to appear one-sided, *i. e.*, naked on the lower; root-leaves small or none; lower stem-leaves spatulate-oblong, sessile or with margined petiole, 4–7 cm. long, mostly obtuse; upper stem-leaves lanceolate, 7–10 cm. long, sessile by a broad base; the leaf-like bracts long-acuminate, gradually reduced upwards to short-linear forms: inflorescence leafy-bracteate, crowded, 10–15 cm. long, curved, ascending: cymes short-peduncled, 3–7-flowered, symmetrically developed but appearing secund by all the parts of the inflorescence being crowded over to the outer or lower side of the prostrate-assurgent stems: sepals broadly lanceolate or abruptly long-acuminate from a broad base, margins scarious, moderately and irregularly serrate, somewhat shorter than the corolla-tube proper: corolla moderately ventricose-ampliate, hardly bilabiate, sparsely white-bearded in the throat, about 3 cm. long, tube proper about one-third the total length, lobes rounded, spreading: sterile filament flattened at apex, moderately yellow, comose or even glabrous; stamens from sparsely short-hirsute to glabrous; capsule firm-coriaceous, conical, two or three times as long as the calyx.

This plant has the general floral character of *P. glaber* Pursh and is certainly closely allied to it. It seems, however, that its stout rootstock, the spreading prostrate habit of its numerous stems, which are always puberulent, the oppositely secund flowers and leaves mark it as specifically distinct. It is, possibly, somewhat local, occurring, so far as observation goes, only on river banks, usually on the otherwise barren sandbars.

Collected at Laramie by Mr. Elias Nelson, June 18, 1897, and fruited specimens later in the season. Type specimen in Herb. Univ. of Wyoming, no. 3185.

EMMENANTHE SCOPULINA.

Small, pubescent but scarcely glandular, cinereous-green, branched from the summit of a slender tap-root; branches short, ascending, two to several, 1–3 cm. long (often so short as to appear stemless): leaves ovate, elliptic or oblong in outline, from crenately lobed to nearly entire, 5–12 mm. long, petioles usually exceeding the blade: flowers in short racemes (sometimes seemingly solitary) from the axils of the leaves; pedicels short, rarely exceeding the calyx in length: sepals linear, obtuse, less than 3 mm. long at anthesis, at maturity exceeding the corolla, about 4 mm. long: corolla yellow, barely equaling the calyx, lobes short, spreading, rounded, wider than long, about 1 mm. long, vertical appendages very narrow and easily overlooked: style sparsely pubescent, hardly equaling the oval ovary, shorter than the mature ovate capsule; style branches very short: capsule exceeding the calyx at maturity: ovules usually 10, all, or most of them, maturing: seeds brown, irregularly ovate, somewhat angled, subacute at both ends, transversely rugose, 2 mm. long, half as wide.

Frequent in the dry sandy shales near the summits of the white cliffs on Green River. It develops early, being found both in blossom and with mature fruit late in May. The affinities of this plant are with those species of the first division of Dr. Gray's Miltitzia section in his Syn. Fl. N. A.

Type specimen in Herb. Univ. of Wyoming, nos. 3026 and 3056, Green River, May 30, 1897.

EMMENANTHE SALINA.

Depressed-spreading, 3–5 cm. across, from glabrate to sparsely viscid-pubescent, obscurely glandular; tap-root slender; the main stem very short and thick, its branches few, short, spreading, not more than 2 cm. high: leaves from oval to oblong, from entire to dentate or pinnately lobed, blade 7–15 mm. long, petiole mostly exceeding the blade: flowers in short few-flowered (3–5, possibly more) racemes, short-pedicelled or nearly sessile: calyx exceeding the corolla; sepals linear, about 3 mm. long: corolla yellow, minute, narrow, its lobes short-ovate, about one-third as long as the tube: pistil about equaling the corolla; style thick, as long as the oval ovary; style branches very short, half as thick as the style: capsule even at maturity shorter than the calyx, three times as long as the persistent style: ovules about 8, not all maturing: seeds flattened, oblong, sub-acute, light colored, transversely rugose and obscurely reticulated, 2 mm. long, half as wide.

This inconspicuous, depressed little plant occurs on Bitter Creek flats where it makes a scattering growth in the loose, ash-like alkali soil that occurs at intervals. In this soil soluble salts are present in remarkable quantity, often five per cent. or more of the whole.

Type specimen in Herb. Univ. of Wyoming, no. 3105, Bitter Creek Station, June 2, 1897.

The Insect-Visitors of Flowers.

By John H. Lovell.

GAULTHERIA PROCUMBENS L. Checkerberry, Creeping Wintergreen.

The low habit of growth of this species amid grass and moss renders it impossible to observe directly in nature the behavior of its insect-visitors. In passing from plant to plant bees are compelled to creep upon the grass or ground. To remedy this difficulty I placed several plants in an inverted position with a specimen of *Bombus ternarius*, taken while at work on the flowers, in a glass-covered box. At first it was greatly disturbed by these unusual conditions, repeatedly seeking the flowers, which were now in full view, beneath the leaves; but at the end of a few hours its movements became more quiet, and it was possible to hold the the plant in its normal position and observe the movements of the bee with a hand magnifier. The front pair of feet cling to the minute recurved teeth of the corolla, the middle pair grasp its sides, and the length of the flower is such that the hind pair rest upon the adherent sepals at the base. The fore part of the head is pressed up as far as possible into the narrowed mouth of the flower, and occasionally the corolla is slit nearly to the base. The proboscis is inserted outside of the ring of stamens, passing over the anthers, and could be readily seen through the translucent side of the corolla, at the base of which the honey is freely secreted. The tongue was extended horizontally in different directions for one or two millimeters. The jarring produced by the bee probably serves to dislodge the pollen, for when the anthers were touched with a needle it fell freely upon a glass plate.

When the flower opens the stigma stands at the same level as the anthers obstructing the central opening. It is not moist or in a receptive condition. *G. antipoda* of New Zealand, according to G. M. Thomson, is likewise distinctly proterandrous. In older flowers the stigma stands in the mouth of the corolla and is covered with a viscid fluid; at this stage no insect can obtain the honey without coming in contact with it. The filaments are dilated so that access to the honey from the inner side is impossible. They, as well as the inner surface of the corolla, are also densely clothed with soft woolly slanting hairs, as a protection against small insects and the wet.

Each anther is tipped by four unequal elastic awns. The two outer processes are shorter and stand obliquely, obstructing the path between the anthers. The terminal awns also diverge, affording a triangular passage for the proboscis of the bee. The tubes are recurved and turn inward slightly, bringing the pores directly at the end, partially facing each other, whereas, in *Gaylussacia resinosa*, the pores face the style. As the proboscis of the insect passes over these openings it is necessarily brought in contact with the pollen. Exteriorly the anther tubes are covered with a soft, white, farinaceous powder much finer than the pollen grains, which probably serves to protect the sensitive tongue of the bee.

The aromatic scented flowers are white with reddish calyx and pedicels. Unsuccessful attempts of bees to puncture the corolla with the mandibles are indicated by double crescent-shaped marks.

Visitors: Hymenoptera—Apidae: (1) *Apis mellifica* L., ☿, not common; (2) *Bombus vagans* Sm., ♂, common; (3) *B. consimilis* Cr., ☿; (4) *B. terricola* Kirby, ♂; (5) *B. ternarius* Say, ☿. July 31–August 3.

CHELONE GLABRA L. Turtle-head.

The English name is due to the form and general reptilian appearance of the flower. The corolla is 25 mm. long, sessile, and firmly held by the imbricated sepals and concave bracts. The upper lip posteriorly is broad and inflated, affording ample room for the body of the bee, which enters entirely within the corolla. A bee, which found difficulty in retreating from getting astride the filaments, was observed to turn completely around. In front the sides of the upper lip are flattened and bend slightly inward to form a keel within which lies the style. The apex is notched with the extreme margins recurved to afford easier ingress.

Midway in the lower lip there is a reëntrant fold, or concavity, which greatly narrows the entrance and from its elasticity causes the corolla to resume its original shape after the visit of an insect.

The mouth is 14 mm. wide and 5 mm. high at the apex of the upper lip. At each angle there is a tuft of hairs and the margins curve downward to exclude rain. This entrance is none too large to admit species of *Bombus*, which I have seen leave flowers because of the difficulty of entering and fly to others with larger openings. In front of the mouth the three-lobed apex of the lower lip forms a narrow convex landing-place. The sides turn abruptly downward so that the upper portion is but 4 mm. broad with pubescent edges. The body of the bee rests upon this landing-place, while the legs grasp the hairy sides and the head is brought directly in front of the corolla mouth.

The four heart-shaped anthers, about 4 mm. long, lie well forward in the angle formed by the sides of the upper lip. Their inner faces are applied together to form a single pollen-receptacle. The contiguous edges are densely woolly to protect the pollen and to prevent the relative displacement of the anthers by connecting the first pair above and the first and second pairs at the sides. The point of attachment of the anther to the filament is thin and membranous, permitting it to rotate freely. The broad and flattened filaments arch outward and run downward and backward to the base of the corolla. The inferior pair rest in two grooves in the lower lip and hold the pollen-reservoir in place. When a bee enters the flower it spreads apart the arched filaments opening the receptacle and covering the thorax with fine, dry grains of pollen.

The style curves upward from the point of insertion to the keeled anterior portion of the upper lip. Behind it stands the rudiment of the fifth stamen. When the flower expands the capitate stigma is appressed to the corolla above the pollen-receptacle. It is exserted by the gradual growth of the style, until it stands in the mouth where an insect entering the flower must come in contact with it. In the absence of guests self-fertilization would probably not occur, for no pollen could be detected on the stigma of flowers kept in my room during the entire period of inflorescence.

The flowers are faintly sweet-scented, white with reddish lips, and honey is secreted on the upper side of a yellow fleshy ring, which is protected by the hairy filaments. Three or four flowers upon each spike usually bloom at the same time. In this locality they are sparingly visited by insects, and have often been watched unsuccessfully. I have repeatedly observed *Philanthus solivagus* flying from flower to flower and examining the lips for honey, but never entering the corolla. *Prosopis ziziae* was taken while endeavoring to penetrate the pollen-receptacle, and diptera may often be seen resting on the flowers. The corolla is sometimes wholly or partially destroyed by some insect, enabling bees to steal the honey.

Visitors: Hymenoptera—Apidae: (1) *Bombus vagans* Sm., ♂; (2) *B. consimilis* Cr., ☿; (3) *B. dorsalis* Cr., ♂. August 16–24.

IMPATIENS BIFLORA Walt. Spotted Touch-me-not.

The structure of both the normal and cleistogamic flowers has been described. August 10th I examined a large number of flowers; none of the spurs were perforated, and they were visited legitimately by *Bombus vagans*, which made from seven to twelve visits per minute. The thorax was plentifully covered with pollen. August 23d to 27th I found hundreds of the flowers perforated and both honey- and bumble-bees stealing the nectar. A honey-bee was watched during twenty five successive visits, and in every instance they were made to the spurs. The number of visits per minute was about ten. Both the honey-bee and *Bombus terricola* were observed in the act of perforating the nectary. The maxillae alone were employed and were moved slowly back and forward for the purpose of puncturing the tissue. The perforation is usually 3–4 mm. from the end of the spur, which is 10–11 mm. long. Sometimes there is but one, sometimes several openings, or there may be a slit 3 mm. long. Though the honey-bee was not seen to enter the calycine sac, it frequently sought the anthers, and as the front of the head was dusted with pollen, inter-crossing would be accomplished if it visited flowers with the stigma exposed. Small coleoptera and spiders occasionally seek refuge in the sac, and various diptera are attracted to the outside by the bright colors.

Visitors: Hymentopera—(*a*) Apidae: (1) *Apis mellifica* L. ☿; (2) *Bombus vagans* Sm., ♂; (3) *B. terricola* Kirby, ☿; (*b*) Andrenidae: (4) *Augochlora aurata* Sm., ♀, entered sac but did not find the nectar. The first three species are common.

CORNUS CANADENSIS L. Bunch-berry.

Flowers small and closely capitate with a single central floret and four lateral clusters, consisting, respectively, in one instance, of 1, 10, 9, 14 and 12,—or 46 florets in all. Conspicuousness is gained by four parallel-veined involucral bracts. Parts of the flowers in fours, petals valvate, and one, or not rarely two, awned. As the flower-bud approaches maturity the filaments grow rapidly, breaking apart the petals at the base and protruding as four V-shaped arches. If at this stage the awl-shaped appendage is touched by the body of an insect, or by a needle, the petals are instantly reflexed, the elastic filaments straighten, and a minute shower of pollen is projected upward. In fully matured flowers a faint snap may be heard. Self-fertilization is prevented by the immaturity of the stigma. The stamens surpass the pistil and in the bud the anthers rest against the style. Both stamens and petals soon fall away and the capitate stigma, composed of white papillae, subsequently matures. Though self-fertilization is prevented by proterandry there may occasionally be observed resting against the stigma the anthers of neighboring flowers. The honey is secreted in a very thin layer by a dark brown ring at the base of the style. There is a profusion of flowers, which remain in bloom a long time.

While the honey-bee and Andrenidae are common visitors there has never been seen upon the flowers a single species of *Bombus*. The absence of these insects is probably due to the small store of honey. Several small butterflies are occasionally attracted, but coleoptera are very rarely taken. A large company of diptera are important agents in inter-crossing. The flowers are frequented by a white spider, *Misumena vatia*, which preys upon the insects guests; in one instance it had captured a honey-bee, in another a crane-fly.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿, common; (2) *Nomada maculata* Cr.; (*b*) Andrenidae: (3) *Andrena vicina* Sm., ♀, common; (4) *A. commoda* Sm., ♀; (5) *A. claytoniae* Rob., ♀, common; (6) *A. designata* Ashm., ♀; (7) *Halictus stultus* Cr., ♂; (8) *H. Cressonii* Rob., ♀; (9) *Sphecodes* sp.; (*c*) Ichneumonidae: (10) *Ichneumon centrator* Say., ♂, rare. B. Lepidoptera—Rhopalocera: (11) *Lycaena pseudargiolus* Bois. & Lec.; (12) *Chrysophanus americanus* D'Urban; (13) *Thecla niphon*

Hub. C. Diptera—(*a*) Syrphidae: (14) *Sphaerophoria cylindrica* Say; (15) *Sericomyia militaris* Walk.; (16) *S. chrysotoxoides* Macq.; (17) *Pipiza pisticoides* Will.; (18) *Criorhina intersistenas* Walk.; (19) *Chilosia tristis* Loew; (20) *Brachypalpus marginatus* Hunter; (21) *Criorhina nigra* Will.; (22) *Xanthogramma aequalis* Lw.; (*b*) Muscidae: (23) *Morellia micans* Macq.; (24) *Lucilia cornicina* Fab.; (25) *Pyrellia cadaverina* L.; (26) *Mydaea alone* Walk.; (*c*) Sarcophagidae: (27) *Helicobia helicis* Town.; (28) *Sarcophaga* sp.; (*d*) Empididae: (29) *Rhamphomyia minytus* Walk.; (*e*) Anthomyidae: (30) *Phorbia fuscipes* Zett.; (31) *Phorbia* sp.; (*f*) Asilidae: (32) *Cyrtopogon chrysopogon* Loew, one specimen; (*g*) Stratiomyidae: (33) *Odontomyia interrupta* Oliv., one specimen. D. Coleoptera—(*a*) Elateridae: (34) *Cardiophorus* sp.; (*b*) Lampyridae: (35) *Ellychnia corrusca* L.; (36) *Telephorus fraxini* Say. July 11–July 1.

CORNUS STOLONIFERA Michx. Red-osier Cornel.

Flowers white, in flat cymes, sweet-scented, honey abundant, secreted by a brown fleshy ring at the base of the style. Stigma covered with a viscid secretion and in a receptive condition when the flower expands, the anthers dehisce within an hour. The stamens stand nearly erect, are rather longer than the pistil and have their pollen-covered sides turned away from the stigma. The flower is 1 cm. broad so that fertilization of the stigma by the anthers of neighboring flowers does not occur. The flower of *Cornus Canadensis* L. is only 3 mm. wide.

The abundance of the honey attracts frequent visits of bumblebees, but the number of diptera is much less than in *C. Canadensis* L. Two species of millers were collected upon the sweet-scented flowers in the evening.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿; (2) *Bombus ternarius* Say, ♂; (3) *B. terricola* Kirby, ☿; (4) *B. borealis* Kirby, ♀; (*b*) Andrenidae: (5) *Andrena salicis* Rob., ♀; (6) *Prosopis sparsa* Cr., ♀; (7) *Sphecodes dechroa* Sm., ♂; (*c*) Eumenidae: (8) *Ancistroceras capra* Sauss., ♂; (*d*) Ichneumonidae: (9) *Ichneumon Wilsonii* Cr., ♂; B. Diptera—(*a*) Syrphidae: (10) *Syrphus rifesii* L.; (11) *Tropidia quadrata* Say; (*b*) Muscidae: (12) *Pollenia rudis* Fab.; (13) *Lucilia caesar* L.; (14)

L. cornicina Fab.: (15) *Morellia micans* Macq.; (*c*) Anthomyidae: (16) *Phorbia fuscipes* Zett.; C. Coleoptera—(*a*) Elateridae: (17) *Corymbites metallicus* Payk.; (*b*) Lampyridae: (18) *Pyropyga decipiens* Harr. July 19–July 24.

CORNUS ALTERNIFOLIA L. Alternate-leaved Cornel.

As the flower expands the anthers and stigma mature simultaneously. The style is 3 mm. long and the stamens 6 mm. so that cross-fertilization would be favored by different parts of the bodies of insects coming in contact with the anthers and stigma. The open white cymes are very numerous and conspicuous, honey is secreted by a green, fleshy ring at the base of the style, odor faint, pleasant. In comparing the three preceding species of *Cornus*, it is noteworthy that in *C. Canadensis* L., where conspicuousness is gained by means of an involucre, the flowers are smaller, more closely set, there is effective provision against self-fertilization and a less abundant supply of honey; an arrangement that permits the honey-bee to visit the flowers so rapidly that the rate per minute could not be determined satisfactorily.

Hymenoptera are the most important agents in inter-crossing *C. alternifolia* L.; diptera are common but play a subordinate part compared with the bees; coleoptera are not common.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿, common, sucking; (2) *Bombus terricola* Kirby, ♀, rare; (*b*) Andrenidae: (3) *Andrena commoda* Sm., ♀, common, collecting pollen; (4) *A. designata* Ashm. ♀; (5) *Andrena* (?) *viola* Rob., ♀ common; (6) *Halictus similis* Sm., ♀; (7) *Halictus* sp.; (8) *Sphecodes dechroa* Sm., ♂, rare; (9) *Agopostemon radiatus* Say, ♀, rare; (*c*) Eumenidae: (10) *Ancistroceras capra* Sauss., ♂. B. Diptera—(*a*) Syrphidae: (11) *Syritta pipiens* L.; (12) *Syrphus rifesii* L.; (13) *Pipiza pisticoides* Will; (14) *Chilosia* sp.; (15) *Helophilus latifrons* Loew; (16) *Temnostoma alternans* Lw.; (*b*) Muscidae: (17) *Pollenia rudis* Fab.; (*c*) Sarcophagidae: (18) *Helicobia helicis* Town.; (*d*) *Chironomidae*: (19) *Ceratopogon* sp. C. Coleoptera—(*a*) Carabidae: (20) *Lebia viridis* Say; (*b*) Cerambycidae: (21) *Leptura lineola* Say; (*c*) Cephaloidae: (22) *Cephaloon lepturides* Newn.; (*d*) Cistelidae: (23) *Isomera quadristriata* Coup.; (*e*) Anthicidae: (24) *Corphyra lugubris* Say; (*f*) Chrysomelidae: (25) *Chrysomela scalaris*

Lec.; (26) *Orsodachna atra* Ahr.; (*g*) Curculionidae: (27) *Anthonomus corvulus* Lec.; (28) *Conotrachelus nenuphar* Hbst. June 19–July 1.

ARALIA RACEMOSA L. American Spikenard.

The size of this species is very variable and in rich, open woodlands may exceed six feet. In three umbels the number of flowers respectively was 39, 44, and 49. Proterandrous dichogamy is strongly developed as in the Umbelliferae. When the flowers open the styles are united and only a millimeter in length, while the stamens are three millimeters long, and stand erect with the anthers horizontal or inclining outward. The smaller diptera thrust their heads between the stamens, but the bodies of the larger pass over them. The first period of the inflorescence closes with the falling away of the stamens and petals.

Subsequently the styles elongate until about 3 mm. long, separate, and finally are reflexed. The stigmas are terminal and oblique, prolonged along the inner side of the style. For so small a flower the honey is abundant, and may be seen in minute drops on the epigynous disk. During the intermediate stage its secretion nearly ceases. The association of the flowers in a community permits insects to visit them rapidly; the honey-bee will make some forty visits in a minute, and *Lucilia cornicina* in the same time will examine twenty-six flowers.

The flowers are frequented by a large number of the less specialized hymenoptera, such as the ichneumon-flies and wasps. Bees with the exception of the honey-bee are not common. Of butterflies, *Argynnis aphrodite* is a very frequent visitor, other species are rarer. The diptera form a large and varied company.

Visitors: A. Hymenoptera—(*a*) Apidae: (1) *Apis mellifica* L., ☿; (2) *Bombus ternarius* Say, ♂; (3) *B. terricola* Kirby, ☿; (4) *B. vagans* Sm., ♂; (*b*) Andrenidae: (5) *Andrena commoda* Sm., ♀; (6) *A. rugosa* Rob., ♀; (7) *Halictus fuscipennis* Sm., ♀; (8) *H. Cressonii* Rob., ♀; (9) *Prosopis* sp.; (10) *Augochlora aurata* Sm., ♀; (11) *Sphecodes dechroa* Sm., ♂; (*c*) Vespidae: (12) *Vespa diabolica* Sauss., ☿; (13) *V. consobrina* Sauss., ☿; (14) *V.* sp., ☿; (15) *V. maculata* Fab., ♀; (d) Eumenidae: (16) *Eumenes fraternus* Say, ♂; (*e*) Crabronidae: (17) *Crabro nigrifrons* Cr., ♂; (18) *C.*

bigeminus Pat., ♀; (19) *C. sterpicola* Pach., ♀; (*f*) Nyssonidae: (20) *Gorytes* sp. nov.; (*g*) Sphecidae: (21) *Ammophila vulgaris* Cr., ♀; (*h*) Pompilidae: (22) *Pompilus scelestus* Cr., ♀; (23) *P.* sp nov.; (*i*) Formicidae: (24) *Formica fusca* L., ♂; (*j*) Chrysididae: (25) *Perilampus triangularis* Brulle; (26) *Chrysis perpulchra* Cr.; (*k*) Ichneumonidae: (27) *Ichneumon Wilsonii* Cr., ♂; (28) *I. versabilis* Cr., ♂; (29) *I. malacus* Say, ♂; (30) *Linoceras cloutieri* Prov., ♂; (31) *Amblyteles subrufus* Cr., ♀; (32) *Gasteruption incertum* Cr. ♀; (33) *G. tassatorium* Say, ♀; (*l*) Tenthredinidae; (34) *Hylotoma clavicornis* Fab. B. Lepidoptera—(*a*) Rhopalocera: (35) *Argynnis aphrodite* Fab.; (36) *A. cybele* Fab.; (37) *A. bellona* Fab.; (38) *Limentis arthemis* Drury; (39) *Melitaea tharos* Drury; (40) *Pamphila Peckius* Kby.; (41) *Chrysophanus americanus* D'Urb. (42) *Lycaena pseudargiolus* Boisd. & Lec.; (*b*) Zygaenidae: (43) *Ctenucha virginica* Charp. C. Diptera—(*a*) Syrphidae: (44) *Syrphus rifesii* L.; (45) *S. lesueri* Macq.; (46) *Sphaerophoria cylindrica* Say; (47) *Xylota analis* Say; (48) *Paragus angustifrons* Loew; (*b*) Muscidae: (49) *Morellia micans* Macq.; (50) *Lucilia caesar* L.; (51) *L. cornicina* Fab.; (52) *Pollenia rudis* Fab.; (53) *Mydaea alone* Walk.; (c) Sarcophagidae: (54) *Helicobia helicis* Town.; (*d*) Tabanidae: (55) *Chrysops celer* O. S.; (56) *C. mitis* O. S.; (57) *Therioplectes epistatus* O. S.; (58) *Cistogaster immaculata* Macq.; (*e*) Tachinidae: (59) *Archytas analis* Fab.; (60) *Echinomyia algens* Wied.; (61) *E. decisa* Walk.; (*f*) Empididae: (62) *Rhamphomyia luteiventris* Loew; (63) *R. minytus* Walk.; (*g*) Dexidae: (64) *Zelia* sp. (*h*) Anthomyidae: (65) *Hydrotaea bispinosa* Zett.; (66) *Limnophora* sp.; (67) *Phorbia* sp. D. Coleoptera—(a) Elateridae: (68) *Elater collaris* Say; (*b*) Lamperidae: (69) *Telephorus flavipes* Lec.; (70) *Pyractomena angulata* Say; (71) *Telephorus fraxini* Say; (72) *Pyropyga decipiens* Harr.; (*c*) Dermestidae: (73) *Anthrenus* sp.; (*d*) Cerambycidae: (74) *Leptura vagans* Oliv.; (75) *L. chrysocoma* Kb.; (76) *L. vittata* Germ.; (*e*) Melandryidae: (77) *Canifa*, sp.; (*f*) Mordellidae: (78) *Anaspis rufa* Say; (79) *Mordella marginata* Melsh. E. Hemiptera—two species. July 9–July 31.

In the determination of insects I am indebted to Prof. H. F. Wickham, and by the courtesy of Dr. L. O. Howard to Messrs. Wm. H. Ashmead and D. W. Coquillet.

WALDOBORO, MAINE.

Abnormal Inflorescence in Saxifraga fallax.

By John K. Small.

(Plate 343.)

While examining one of the original specimens of Prof. Greene's lately described *Saxifraga fallax* I was surprised to find a most astonishing state of affairs in the inflorescence. The flowers in many cases have lost their symmetry and the different whorls usually possess a greater or less number of parts than the normal.

A flower of any species of *Saxifraga* should have five calyx-segments, five petals, ten stamens, and, in the subgenus *Micranthes*, two carpels. There are normal flowers on this one specimen of *Saxifraga fallax* together with the seven following teratological cases:

1. Figure 1 represents a normal flower.

2. The pedicels of some flowers are elongated and adnate to other pedicels as shown in fig. 2, making it appear as if one calyx is borne from another.

3. Other flowers have four calyx-segments, four petals, eight stamens and the normal two carpels as shown in fig. 3.

4. A few flowers possess the normal five calyx-segments and five petals but the androecium and gynoecium have respectively twelve stamens and three carpels, as indicated in fig. 4.

5. As shown in fig. 5 other flowers have developed six calyx-segments, six petals and twelve stamens, the only normal part being the gynoecium.

6. A rare condition is fig. 6 where we find six calyx-segments, six petals and four carpels; here the only normal whorl is the androecium.

7. Fig. 7 is the drawing of a petal in which only one lateral nerve has developed.

8. I noticed several extremely abnormal petals as indicated in fig. 8. In fact the organ was about half way between petal and stamen; the blade was folded and hooded at the apex and at the front of the hood was situated a rudimentary anther. I have examined several hundred specimens of *Saxifragae*, but this example surpasses anything I have observed in the genus as far as abnormal flowers are concerned.

Eleocharis melanocarpa a proliferous Plant.

By E. J. Hill.

(Plate 344.)

In the summer of 1894 I found this plant in two localities of northern Indiana in the region of the Great Lakes—Laporte and Dune Park. The former station is about twenty miles from Lake Michigan and the plants were growing in the sandy borders of Pine Lake, one of the cluster of little lakes on which Laporte is situated. The latter station is in the dune region by the shore of Lake Michigan, where the plants occur plentifully in the damp sandy margins of sloughs. Previous to that time it had been reported only from the Atlantic coast, ranging from Massachusetts to Florida. Aside from the interest it has in common with several other plants which connect the flora of the dune region with that of the Atlantic coast, a new feature was added last summer by the discovery of a proliferous habit among the plants at Dune Park. In this respect it is associated with *E. rostellata* Torr. The first that were seen were supposed to be this species, which is known to grow in southern Michigan, the locality also being within its geographical range, but I am not aware of its presence here. The lack of fruit in the specimens first obtained was an easy source of error, since the compressed stems are quite alike in both. More careful searching of the area revealed some fruiting stems on the same root with the proliferous stems and these at once showed the species to be *E. melanocarpa* Torr. The peculiar achene makes it very easy to distinguish when the fruit is mature. The tubercle is very broad and flat, its projecting edge rolled over and surrounding the top of the nut like a miniature scroll. Torrey states it well in his original description: "Tubercle very short and dilated, the margin thickened and projecting over the top of the nut." *

E. melanocarpa commonly grows in stools, several roots, with from five to twenty stems each, being bunched together. Bunches sometimes occur a foot and more in diameter. In the case of the proliferous clusters, though several of the stems might be provided with spikes, these were nearly always fruitless, the scales being empty or the flowers or aborted fruit only present. But a few perfect achenes, perhaps but one, appeared in a spike even when the fruit matured. The strength of the plant was expended on the proliferous stems. Spikeless stems which might have rooted had they bent over and reached the ground often stood erect among the stems bearing the empty heads. The proliferous stems vary in length from 3 to 11 decimeters. They are gradually and uniformly recurved, arching over till the end comes in contact with the soil. Though the erect stems are mostly shorter, they are in many cases as long as the recurved. In no case did these seem the weaker of the two, the diameter of the stems being substantially the same in both. After the curvature has begun and the stems have increased in length they might relatively be called weaker, and would come more under the influence of gravity and the end be pulled downward. But from the initiatory steps and the regularity of the curve, almost a perfect bow, the stems manifest a geotropic habit, the necessities of the additional mode of propagation inducing a movement toward the ground.

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* Cyperaceae of North America, Ann. Lyc. N. Y. 3: 316. 1836.

The barren stems produce at the tip two scales relatively prominent and facing each other with their sides in the plane of the flattened sides of the stem. Where spikes are developed, these two scales are usually larger and thicker than those subsequently formed, appearing like small involucral scales at the base of the head. The scales of the spikeless stems inclose a few others which are small, thin, and hyaline. From three to six shoots spring from their axils when they become proliferous, taking the place of the achenes. They are minute bulblets starting from a bud encased in a thin, outer enveloping scale which grows in length and forms the sheath surrounding the base of the stem. At the base of the bulblet a small projection appears, showing the beginning of the root system. (Fig. 5, *a*.) Some of the bulblets may show these protuberances before the roots on any of the clusters have burst out and connected the plants with the ground. The young stems may be an inch or two high before roots appear. The bulblets develop successively, the stems being quite unequal in length. The connection with the parent stem may last for some time, new shoots from 12 to 25 centimeters high being found attached to the end of a stem, but the union is so slight at that stage that it is broken with the slightest disturbance. (Figs. 2 *a* and 2 *b*.) The connection is strong until the new shoots are well rooted.

Thanks are due Mrs. Agnes Chase, of Chicago, for the drawing to illustrate this paper.

Explanation of Plate 344.

FIG. 1. *Eleocharis melanocarpa* Torr., showing culms proliferous at the summit, ½ natural size.

FIG. 2 *a*–2 *b*. Young plants so produced, basal portions, natural size.

FIG. 3. Achene, enlarged 5 diameters.

FIG. 4. Spike, natural size.

FIG. 5. Proliferous bud showing protuberance (*a*) from which roots spring, enlarged 5 diameters.

FIG. 6. Proliferous bud, older stage, with root, enlarged 5 diameters.

Two Phaenogamous Parasites of the Red Clover.

BY BYRON D. HALSTED.

The season of 1897 was remarkable in New Jersey for the unusual development of dodder (*Cuscuta Epithymum* Murr.), upon the red clover (*Trifolium pratense* L.). Extracts from two of the many letters that were received concerning this parasite will indicate the extent of the trouble. "While cutting the clover the machine would suddenly enter a thread-like mass, which clogged it completely. * * * The wilted mass formed a sort of blanket which could be rolled up. * * * There were about fifteen of these beds averaging six feet in diameter to the acre. * * * In these beds everything is as dead as if burned over with fire." From another letter it is gathered that the dodder formed "A dense mat almost obscuring the clover stems. * * * In some places the clover is killed."

These extracts indicate how active the dodder may become when once it gains a foothold in the clover field. One field of over ten acres not more than three miles from the Experiment Station was left uncut, because so completely overrun by the dodder, and suggests that the seed of the parasite was sown as foul stuff along with the clover seed. While nearly the same shape as the clover, the dodder seed is not more than one fourth as broad or long and should be easily separated by an ordinary fanning mill with properly adjusted sieves. It is not unlikely that, when the dodder is once upon a farm, it gets distributed in the manure.

This species of dodder is one of the most delicate and beautiful of the genus, the slender stems being almost hair-like in their fineness and the flowers taking on in some cases a rose pink as delicate as that of the trailing arbutus. The extreme attractiveness of the charming tint of the small clusters of tiny blossoms is brought out as met with upon the stems and leaves of the common wild carrot (*Daucus Carota* L.). The accompanying engraving shows the infested wild carrot plant, and emphasizes the fact that the species is not confined to the clovers. It sometimes grows upon

the timothy grass when associated, as it frequently is, with the clover in the meadow.

In looking over a large number of state and local floras this dodder is mentioned in but two. Beal and Wheeler's "Michigan Flora," 1892, page 117, states "introduced at Salem with alfalfa seed." It is listed in Millspaugh's "Flora of W. Virginia," page 223, and also in his "Preliminary Catalogue." The same author in his "Illustrated Descriptive List of Weeds" figures the clover dodder and states that "only one report of this dreaded parasite so detrimental to clover fields has come to me in this State; that from Greenbrier county where it was probably imported in clover seed from England."

The dodder is given a plate in the report of the Botanist of the United States Department of Agriculture for 1890 and is mentioned as prevalent in Missouri.

These notes only increase the value of a record of the outbreak that was experienced by the farmers in New Jersey in 1897.

The second flower-bearing clover parasite is the broom-rape (*Orobanche minor* J. E. S.). Mr. L. S. Davis, a college student from Cumberland county, brought me specimens of this plant which he found growing in some abundance upon the red clover in the southern part of the State near Shiloh.

While a somewhat familiar plant in the Old World this clover parasite is rarely met with in the United States. After an examination of a long list of state and local floras the writer fails to find it listed outside of New Jersey, except in Ward's Guide to the Flora of Washington and Vicinity and Holm's Additions to Flora of Washington in which it is recorded that Prof. E. S. Burgess found it at Mount Vernon Square. Gray's Flora of North America gives New Jersey to Virginia as its range and states that it is "sparingly and probably recently introduced."

It was taken by Mr. Clute at Tom's River, N. J. in the summer of 1883 and by Mrs. W. McGeorge at Woodbury, the date not being recorded with the specimens that are in the herbarium.

In Britton's Flora of New Jersey mention is made of three other localities in the State where the broom-rape has been taken.

From all that is learned the Shiloh region is the only one where the parasite has become so abundant in the United States as to attract attention and prove destructive to the clover. If the *Orobanche minor* is more widely distributed than the above note would suggest the writer would be pleased to learn of its range.

It is also remarked that the broom-rape made its presence felt in the same year when the dodder of the same host was most abundant for a long time. The peculiarities of an excessively wet July when the rainfall was 11.42 inches and more than double the average amount, may have had something to do with the outbreak in case of both of the phaenogamous parasites.

RUTGERS COLLEGE.

Mosses of Northern India.

By E. G. Britton.

In a recent publication entitled "Contributions to the Bryological Flora of the Northwestern Himalayas" (Acta Soc. Sci. Fenn. **24**: 46, pp. 1898) V. F. Brotherus enumerates the mosses collected in various parts of the Himalaya mountains, especially in Sikkim and the valley of Kashmir. A brief account of the region is given by Mr. Duthie, director of the Forest Department of northern India, from which it appears that the whole region is a mountainous one, the average elevation above the sea being 6,000 feet, the main ranges extending from northwest to southeast and including several peaks from 20,000–26,000 feet high, which give rise to some of the largest glaciers in the world. Yet owing to its latitude, 35° N., agreeing with that of the southern boundary of North Carolina, the sun's rays are too hot for the growth of mosses on the southern slopes, and the bryological vegetation comes nearest to that of Central Europe. It is surprising to find that out of the total number listed, 49 genera and 96 species are found in North America as well, and in many genera all but two or three species are identical. This is true in the following: *Encalypta*, *Pohlia*, *Bryum*, *Mnium*, *Bartramia*, *Timmia*, *Leucodon*, *Anomodon*, *Leskea*, *Pterigynandrum*, *Pseudoleskea*, *Pylaisea*, *Brachythecium* and *Amblystegium*. Dr. Venturi has named the *Orthotrichums* and has determined one of the species to be the same as one of our recently discovered Rocky Mountain ones, *O. Schlotthaueri*. We note with particular interest also that *Fissidens grandifrons* was collected only sterile, so that Falconer's station still remains the only one from which this moss is known in fruit. Several other species which are common to the Rocky Mountains or our highest Alleghanies are *Dicranoweisia cirrata*, *Oncophorus virens*, *Distichium capillaceum*, *Barbula rubella*, *Desmatodon latifolius*, *Grimmia commutata*, *Amphidium lapponicum*, *Leptobryum pyriforme*, *Neckera pennata*, *Myurella julacea*, *Thuidium abietinum* and *Orthothecium intricatum*. A few common, cosmopolitan mosses are *Ceratodon purpureus*, *Funaria hygrometrica*, *Philonotis fontana* and *Polytrichum juniperinum*. Two North American species of *Hypnum*, *Stereodon Haldanianum* and *S. reptile* (Michx.) Brotherus, the latter a new combination, it appears, are also notable.

Proceedings of the Club.

WEDNESDAY EVENING, MARCH 30, 1898.

Three new active members were elected.

The scientific program included three papers, of which the first, by Dr. V. Havard, Surgeon U. S. A., was upon "The English Names of Plants." The following is an abstract :

"The necessity for English names being recognized, botanists should decide on the principles which are to determine their selection and formation, so as to secure greater uniformity, simplicity and usefulness. To each plant an authorized vernacular binomial should be assigned so that ambiguity and confusion may be avoided. In the absence of suitable English names already recognized, it seems best to adopt the Latin genus-name, if short and easy, like *Cicuta*, *Parnassia*, *Kalmia*, *Hibiscus*, or a close translation thereof, when possible, like Astragal, Chenopody, Cardamin, while the specific English name should be an equivalent of the Latin one or a descriptive adjective.

"As to construction, the rules recommended are as follows :

"In case of all English binomials clearly applying to well-known individual species and no others, all substantives are capitalized without hyphen, as in Witch Hazel, May Apple, Dutchman's pipe. In all genera in which two or more species must be designated, the genus name is compounded into one word without hyphen, as Peppergrass, Sweetbrier, Goldenrod, Hedgenettle, etc., except in long names, where the eye requires the hyphen, as Prairie-clover, Forget-me-not. Genus names in the possessive case (St. John's-wort) are written with the hyphen, followed by a lower-case initial. Plants commemorating individual men (Douglas Spruce, Coulter Pine) are written without the mark of the possessive.

"In specific names, participial endings are suppressed, the participle becoming a substantive which is added as a suffix, without hyphen ; thus Heart-leaved Willow is changed to Heartleaf Willow."

Discussion followed, Dr. Britton, Mr. Clute, Dr. Rydberg, the Secretary, and others participating. Commendation was given to the attempt to simplify, to make use of the vernacular, and to secure greater euphony. President Brown and Dr. T. F. Allen deprecated the manufacture of book-names. Dr. Allen also pointed out the confusion which has resulted from the improper transfer of English and German names to plants which are kindred, but not identical. The Secretary defended the use of vernacular names, saying that they deserve more attention, and that in their absence the generic name should be used unchanged. "Many Latin names as *Portulaca*, win their way without change as soon as once fairly made familiar. Coined names seldom live ; a name to be successful must be a growth, as language is. Allowance must be made for new discoveries, even in supposed monotypic genera. Names like Witch-hazel are fitly treated as themselves generic, not binomial. To drop the possessive often loses from our thought an association with the discoverer which is worth preserving. To drop the participle ending -ed is often however a distinct gain, both in securing compactness and expressiveness."

The second paper by Dr. N. L. Britton, "The Genus *Parthenium* in Eastern North America," was a description of a new species of *Parthenium*, from near Charlotte, Va., intermediate in leaf-margin between the pinnatifid leaves of tropical species and the subentire leaves of the type *P. integrifolium*. Plants of the latter from White Sulphur Springs, Va. are now cultivated at the N. Y. Botanic Garden.

The third paper, "The Influence of the Nucleus upon the Formation of Cell Walls," was by Prof. C. O. Townsend; a summary is as follows :

"It was observed by Klebs (Pfeffer, Untersuch. a. d. Botan. Inst. z. Tüb. **2** : 500) in 1888, that when cell conents are separated into two or more parts by plasmolysis, only the part conaining the nucleus is capable of forming a new cell wall. In the following year Palla (Flora, 1890, p. 314) performed a series of experiments in which cell walls seemed to be formed around the nucleus-free protoplasmic masses. The experiments undertaken in 1895 by the writer (Pringsheim's Jahrbücher, 1897) were solely to determine whether or not the nucleus is necessary for the formation of cellulose. It was found that when the cell contents were plasmolysed, the protoplasmic masses usually remained connected by protoplasmic threads. When these threads were broken so that there was no possible connection with a mass of protoplasm containing a nucleus, no new cell walls were formed. If a protoplasmic mass was completely separated from the nucleus in its own cell, it was found that the influence necessary for the formation of cell walls could travel from the adjacent cells by means of the protoplasmic connections. Simple contact without living protoplasmic connections was not sufficient to induce the formation of cell walls. If, however, the protoplasmic connections were not broken the influence of the nucleus was capable of traveling over a distance of several millimeters."

TUESDAY EVENING, APRIL 12, 1898.

Mrs. Britton called attention to the efforts in progress to raise a fund in aid of botanical work at Barnard College in memory of the late professor there, Dr. Emily L. Gregory.

The scientific program followed.

1. Dr. Underwood presented a paper by Rev. E. J. Hill, of Chicago on "*Vitis Labrusca* and its westward Distribution," describing its growth on the sand-hills south of Lake Michigan, there showing among its specific characters, a tough skin and pulp, large seeds, blue to vinous-purple color, and globose or depressed fruit even larger than in cultivated varieties such as the Concord.

Discussion followed, Dr. Britton speaking of the high value to be attached to the character founded on intermittent tendrils. The Secretary and Dr. Rusby spoke of pink, purple, and other colors among its variants in nature. Dr. Rydberg mentioned a similar wide range of color-variants in *Prunus* in Nebraska, where leaf and other characters may be indistinguishable, but the fruit will vary in color, and also in flesh, taste, and flavor.

2. A communication on "South American Piperaceae" was presented by Dr. Rusby, on behalf of Prof. Casimir De Candolle. De Candolle, in studying the last of the collections in this family made by Mr. Bang, had also determined a considerable number of Bolivian specimens pertaining to the early collections of Weddell, Mandon, and others. Among the results were the eleven new

species now described. These new species were exhibited, and remarks were also made by Dr. Rusby descriptive of the habits and appearances of these plants as they grow in the Andes.

Dr. Britton spoke of the interest attaching to the Piperaceae as the simplest type of the Dicotyledons, because of the simple character of the carpel, fruit, and tissues. Dr. Rusby referred to the separation of *Saururus* from the Piperaceae, and to Dr. Henry's investigations now in progress upon a *Saururus* in China.

3. The next feature of the evening was the exhibition by Dr. Britton of a large and interesting set of blue prints from tracings made from Mexican plants. The originals were sent by Mocino and Sesse to M. Alphonse De Candolle at Geneva ; but these and the accompanying text remained unpublished. Recently the text has been issued by the Mexican Natural History Society. The elder De Candolle furnished a series of tracings to Dr. Gray from which the blue-prints exhibited have been made at the instance of Dr. J. N. Rose, of Washington, D. C. An index and preface to the blue-prints has been supplied by M. Casimir De Candolle.

4. The subject next following was that of those members of the Convolvulaceae which form large fleshy roots, introduced by Dr. Rusby, who exhibited specimens of the roots of *Ipomoca pandurata* sent by Mr. C. R. Beadle, of Biltmore, N. C. Three fusiform roots reached each from 3–4½ feet long, 3–5 inches thick, and also developed at least one foot of slender root above, below the surface of the ground. One of these was forked, suggesting its name of "Man-in-the-Ground." Medicinally, it is used as a purgative.

Dr. Rydberg referred to the thicker, shorter root of *Ipomoea leptophylla*, which has a sweet taste, and frequents hillsides, where its roots serve as a storehouse for moisture as well as for starch.

Dr. Rusby suggested that the resinous matter found in these roots may be primarily a waste product, but is perhaps useful to the plant as a means of preventing its being eaten by enemies.

5. The next communication was from Mrs. E. G. Britton, on "A Hybrid Moss." Mrs. Britton exhibited contribution No. 72 from the Herbarium of Columbia University, reprinted from the BULLETIN for February, 1895, showing plate 231, to illustrate a hybrid of *Aphanorhegma serratum* collected by Drummond near

St. Louis, Missouri, in 1841, and stated that the same hybrid had been rediscovered by Mr. D. A. Burnett, on December 12, 1896, near Bradford, Pennsylvania, along the Erie Railroad, on a heap of ashes left by burning old ties, and that it was associated with *Bryum argenteum* and *Funaria hygrometrica.* As in the case of Drummond's specimens the antheridial parent is unknown, but was probably *Physcomitrium turbinatum;* it scarcely seems possible that it could have been *Funaria.* The specimens agree in every way and show various evidences of inheritance from each parent. On most of the plants, typical immersed capsules of *Aphanorhegma* occur together with either one exserted, long-pedicelled capsule of *Physcomitrium* or with two smaller immersed capsules more closely related to *Physcomitrium* than to *Aphanorhegma.* As in Drummond's specimens, the apical lid with a clearly differentiated border, the shallow spore-sac, and especially the different cell-structure of the walls and the less developed spores, clearly distinguish the hybrid sporophytes from typical *Aphanorhegma.*

Discussion followed regarding hybrid ferns, and respecting *Asplenium platyneuron* and *A. ebenoides.* In answer to questions by Dr. Rusby, Dr. Underwood said that where both species grow together in Alabama, he finds *A. ebenoides* growing beneath cliffs, but *A. platyneuron* in different situations about the edges of bowlders, while the associated fern *Camptosorus* inhabits only the flat tops of the rocks.

EDWARD S. BURGESS, *Secretary.*

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VOL. 25 NO. 8

BULLETIN

OF THE

TORREY BOTANICAL CLUB

AUGUST 1898

An Enumeration of the Hepaticae Collected by John B. Hatcher in Southern Patagonia.

BY ALEXANDER W. EVANS.

(PLATES 345–348.)

The territory of Patagonia, and particularly the regions neighboring the Straits of Magellan, have several times been visited by scientific expeditions. Most of these have made collections of Patagonian plants and have included the hepaticae among them, either incidentally or systematically. Our knowledge of the hepatic flora of this remote country is, therefore, sufficient to give us some idea of its exceeding richness and variety. Although a few of the most conspicuous species were gathered in the first years of the present century and even earlier, the real foundations of our knowledge are based on the collections made during the Antarctic voyage of the British ships *Erebus* and *Terror*, in the years 1839–43. These important collections were studied by Sir Joseph D. Hooker and Dr. Thomas Taylor, and their preliminary account* of the species found was later amplified into a fuller description† accompanied by numerous colored figures.

Passing over several smaller gatherings attention may further be called to three larger collections, which have been made and described within recent years. The first of these collections was that of Dr. Spegazzini, which was made in 1882 and included 103 species, most of which came from Fuegia. The determinations

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* Hepaticae Antarcticae; being characters and brief descriptions of the Hepaticae discovered in the southern circumpolar regions during the voyage of H. M. Discovery Ships Erebus and Terror. Lond. Jour. of Bot. **3**: 366–400, 454–481. 1844.

† Flora Antartica, **2**: 423–446. *pl. 156–161.* 1847.

[Issued 13 August.]

were by Prof. Massalongo, of Ferrara, who published an illustrated account* of the species collected, describing 27 as new. The second collection was made under the direction of the French "Mission Scientifique du Cap Horn," and was studied by M. Bescherelle, of Paris, and Prof. Massalongo. A preliminary paper† by these writers described the new species and varieties, and their memoir,‡ published a little later, gave a complete enumeration of the plants in the collection with illustrations of many interesting forms. In their list, which includes a number of species found by Dr. Savatier on the western coast of Patagonia, we find 88 species, of which 12 are considered new. The third collection was made by Dr. Naumann during the voyage of the German ship, the *Gazelle*.

Although collected in the years 1875 and 1876, the account of these hepaticae was not published until 1890. They were first studied by Dr. Gottsche, of Altona, who made drawings of the various species collected. He also began but did not finish the work of description, and his notes were afterwards revised and completed by Dr. Schiffner, of Prague, who made use of many of Gottsche's figures in the published account§ of the collection. 69 species from the Straits of Magellan are included in this enumeration, and, of these, 16 are described as new.

The present report is based on a collection made by Dr. John B. Hatcher in the years 1896 and 1897, while engaged in geological field work for Princeton University. Nearly all the plants were found either at Lapotaia on the southern coast of Fuegia or at Villarina Bay, about a day's journey to the westward of Lapotaia, both stations being situated on the Beagle Channel. A very few species came from the Cordilleras of Patagonia. The collection, which numbers 53 species, includes few novelties, but is of interest in adding to our knowledge of certain rare and incompletely known forms.

---

* Epatiche della Terra del Fuoco raccolte nell'anno 1882 dal Dott. C. Spegazzini. Nuovo Giorn. Bot. Ital. 17: 201–277. *pl. 12–28.* 1885.

† Hepaticae novae americanae-australes. Bull. de la Soc. Linn. 626–632, 637–640. 1886.

‡ Hépatiques récoltées par la Mission francaise du Cap Horn au 1882 et 1883. Comptes rendus de la Mission Scientifique du Cap Horn, 5: 201–252. *pl. 1–5.* 1889.

§ Lebermoose (Hepaticae) gesammelt auf der Reise S. M. S. Gazelle vorzüglich in der Magellan-Strasse, auf der Malayischen Inseln und Kerguelen-Land, 1–48. *pl. 1–8.* 1890.

In the preparation of this paper I am especially indebted to Dr. B. L. Robinson for allowing me access to the Taylor Herbarium, to Herr Stephani for helpful notes, drawings and specimens, and to Prof. Nathorst for the loan of two of Ångström's types. Other correspondents who have given me assistance will be mentioned under particular species.

1. ADELOCOLEA UNCIFORMIS (Hook f. & Tayl.).

Jungermannia unciformis Hook. f. & Tayl. Lond. Jour. Bot. **3**: 457. 1844.

Plagiochila unciformis Hook. f. & Tayl. in G. L. & N. Syn. Hep. 653. 1847.

Adelanthus unciformis Spruce, Jour. Bot. **5**: 200. 1876.

Plagiochila sphalera Hook. f. & Tayl. in G. L. & N. Syn. Hep. 653. 1847.

Jungermannia haliotiphylla De Not. Mem. Acc. Tor. II., **16**: 217. *f. 5.* 1857.

Adelanthus Lindenbergianus (Lehm.) Mitt. Jour. Linn. Soc. **7**: 244. 1864.

Lapotaia.

As Mitten * has already pointed out, there is a genus *Adelanthus* older than his own. It is the *Adelanthus* of Endlicher, which is now regarded as a synonym of *Pyrenacantha* Wight. Mitten suggests that the name "*Adelocolea*" be substituted for his *Adelanthus* but makes the change in only one species, viz., *Adelocolea decipiens* (Hook.) Mitt.

2. ANDROCRYPHIA PORPHYRORRHIZA Nees in G. L. & N. Syn. Hep. 470. 1846.

Jungermannia porphyrorrhiza Nees in Mart. Fl. Bras. **1**^{1}: 343. 1833.

Noteroclada porphyrorrhiza Mitt. Bot. of Kerguelen Island: Transit of Venus Exped. 37. 1874.

Jungermannia confluens Hook. f. & Tayl., Lond. Journ. Bot. **3**: 478. 1844.

Androcryphia confluens Nees in G. L. & N. Syn. Hep. 471. 1846.

---

* Challenger Exped., Bot. **1**^{2}: 106. 1884.

Villarina Bay.

In Hooker and Taylor's Hepaticae Antarcticae, the authors did not divide the old genus *Jungermannia* into distinct genera, but simply into subgenera and the name *Noteroclada* was given to one of these. Two years afterwards, in the Synopsis Hepaticarum, Nees von Esenbeck raised the group to generic rank, but, instead of retaining for it the name *Noteroclada*, substituted the name *Androcryphia.* The latter, therefore, is the oldest for the group as a genus and ought to be retained.

3. ANEURA CALVA Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 42. *pl. 8. f. 16.* 1890.

Fuegia.

4. ANEURA CRISPA (Schiffn. & Gottsche) Steph. Hedwigia **32**: 137. 1893.

Pseudoneura crispa Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 41. *pl. 8. f. 14, 15.* 1890.

Fuegia.

The specimens agree with a part of the type-material, kindly sent me by Professor Schiffner.

5. ANEURA FUEGIENSIS (Massal.) Evans, Contr. U. S. Nat. Herb. **1**: 142. 1892.

Riccardia Fuegiensis Massal. Nuovo Gior. Bot. Ital. **17**: 255. *pl. 26. f. 34.* 1885.

Lapotaia.

6. ANEURA PREHENSILIS (Hook. f. & Tayl.). Not Mitt. in Hook. f. Handb. N. Zeal. Fl. 543. 1867.

Jungermannia prehensilis Hook. f. & Tayl. Lond. Jour. Bot. **3**: 480. 1844.

Metzgeria prehensilis Hook. f. & Tayl. in G. L. & N. Syn. Hep. 505. 1846.

Acrostolia prehensilis Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 431. 1877.

Riccardia prehensilis Massal. Nuovo Gior. Bot. Ital. **17**: 255. 1885.

Aneura Savatieri Steph. Hedwigia **32**: 26. 1893.

Villarina Bay.

There has been so much confusion regarding this characteristic plant of southern Patagonia that it seems wise to give a brief review of the literature concerning it and to emphasize again its most important peculiarities. The original description of *Jungermannia prehensilis* (like all in Hooker and Taylor's paper) consists of two parts—a diagnosis in Latin, and a somewhat fuller account in English with comparative remarks. In the Synopsis Hepaticarum we find the diagnosis simply repeated and the English account translated into Latin, so that this description contains nothing new and is essentially like the original. In the Flora Antarctica again, what is practically the same description reappears but this time is supplemented by a figure of the plant with slightly enlarged details. This original description is, of course, incomplete and the part which applies to the vegetative characters of the plant, particularly so. The following extracts include all the points brought forward about the thallus: "Fronde laxe caespitosa erecta incurva alata; lobis alternis secundis pinnatis, pinnulis planis linearibus crassinerviis;" "Frondes loosely tufted, with broad hooked tips, the stem flat, brown, pubescent, the pinnules are smoother and of a pale olive green." The plant is compared with *Jungermannia eriocaula* Hook., which is said to be darker green and to have a tripinnate frond with narrower pinnules. Only one station is given, Hermite Island, Cape Horn, and no others are mentioned either in the Synopsis or in the Flora Antarctica.

In the Flora Novae Zelandiae, Mitten * applies the name *Sarcomitrium prehensile* (changed to *Aneura prehensilis* in the Handbook) to a plant with *smooth* epidermis, and apparently considers it identical with the Fuegian species. With the exception of this character, his description does indeed agree very closely with that of Hooker and Taylor. Massalongo, on the other hand, says of his *Riccardia prehensilis*: "Cellulae superficiales thalli in appendicem mamillaeformem pulcherrime prominent," and Schiffner calls attention to the same peculiarity. Still more recently Stephani, basing his opinion on New Zealand specimens of *Aneura prehensilis* presumably determined by Mitten, describes a Patagonian plant as *Aneura Savatieri* n. sp. and names as his type some of the material referred by Bescherelle and Massalongo to

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* Op. cit. 2: 167. 1855.

Riccardia prehensilis. His description is very clear, the account of the epidermis being as follows: "Cellulae * * * corticales depresso-imbricatulae, *i. e.*, apex cellulae papulosae supra cellulam proximam parum protractus; margo ubique hyalino subcrenulato." He remarks further: "*Aneura prehensilis* (ex insula N. Zelandia) multo robustior est, epidermide *plano-cellulosa.*"

In view of these conflicting opinions, I have consulted Taylor's original specimens of *Jungermannia prehensilis* from Hermite Island. They are remarkably free from admixture and show the peculiar papillose epidermis described above, indicating that the Patagonian plant is to be looked upon as the true *Aneura prehensilis* (Hook. f. & Tayl.). The New Zealand plant with the smooth epidermis is probably an unnamed species.

The papilliform epidermal cells of *Aneura prehensilis* are somewhat variable in their distribution; on some stems they occur on both surfaces, on others, only on the antical surface, while on the pinnules they are scattered and sometimes few in number. A robust rachis is about 15 cells thick, but its cells are unlike those found in most members of the genus; on the outside there are one or two layers of rather thin-walled cells (including the epidermis) and just inside these are two or three layers of cells with very thick brown walls, the thickening being deposited unequally and leaving irregular cell-cavities; the interior is filled with cells having slightly thickened pale walls. These different kinds of cells do not vary markedly in size.

The nearest ally of *Aneura prehensilis* is the more robust *A. eriocaula* of New Zealand. In this species the rachis, as described by Leitgeb,* is essentially like that of the Patagonian plant. The epidermis also shows papilliform cells, but the papillae, instead of being appressed, stand out from the rachis at right angles and give it a hirsute appearance.

7. ANEURA SPEGAZZINIANA (Massal.) Steph. Hedwigia **32**: 138. 1893.

Riccardia Spegazziniana Massal. Nuovo Gior. Bot. Ital. **17**: 254. *pl. 25. f. 32.* 1885.

Fuegia.

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*Unters. über die Leberm. 3: 49. 1877.

8. ANTHOCEROS ENDIVIAEFOLIUS Mont. Voy. au Pôle Sud. Bot. Crypt. **1**: 211. 1845.

Lapotaia.

The plants referred to this species agree closely with the detailed description of Massalongo * as well as with the more meager original description of Montagne. In the Taylor Herbarium, there is an *Anthoceros* from Cape Horn, labeled *A. punctatus* which belongs here, and, judging from the description, *A Jamesonii* Tayl.† is also to be considered a synonym.

9. BLEPHARIDOPHYLLUM DENSIFOLIUM (Hook.) Ångstr. Öfversigt af Kongl. Vetensk.-Akad. Förhand. **29**, Häft 5: 151. 1874.

Jungermannia densifolia Hook. Musc. Exot. *pl. 36.* 1818.

Scapania densifolia Nees in G. L. & N. Syn. Hep. 72. 1844.

Diplophyllum densifolium Mitt. Jour. Linn. Soc. **15**: 69. 1875.

Martinellia densifolia Trev. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 411. 1877.

Villarina Bay.

A very variable species, including *Jungermannia vertebralis* Hook. f. & Tayl., *J. chloroleuca* Hook. f. & Tayl. and *J. pycnophylla* De Not.

10. BLEPHAROSTOMA PILOSUM sp. nov.

Sterile: densely caespitose, brownish-green; stems erect, simple or with a few lateral branches, sparingly or not at all radiculose, the rhizoids, when present, coming from the basal cells of the underleaves; leaves and underleaves similar, transversely inserted, concave, broadly orbicular-quadrate in general outline, deeply 4-parted (about $\frac{4}{5}$), the segments lanceolate, 4–7 cells wide at base, tapering into capillary points (each composed of a single row of 5 or more cells), and bearing on their margins 5–8 pairs of opposite widely divaricate capillary teeth, becoming successively longer toward the base; upper teeth composed of a single row of cells, lower teeth strongly deflexed, often 2 cells wide in the lower part and giving off a pair or two of tertiary teeth, the external basal teeth of the outer segments much larger than the others and making the leaves appear 6-parted; undivided basal part of the leaves about 4 cells across: leaves subtending branches similar to

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* Nuovo Gior. Bot. Ital. **17**: 258. 1885.

† Fl. N. Zeal. **2**: 171. 1855.

the others but only 2-parted (though often apparently 4-parted from the large size of the external basal teeth of the segments): leaf-cells oblong, rather thick-walled but without trigones; cuticle often indistinctly and minutely verruculose-striate, especially toward the base of the leaves.

Stems 1–2 cm. long, 0.2 mm. wide; leaves 0.85 mm. long and wide, leaf-cells averaging 46 μ long, 14 μ wide. [Plate 345, figs. 1–6.]

Villarina Bay.

The leaves of the present species are so copiously and finely dissected that the plant reminds one at first glance of a *Trichocolea*, but the scanty branching, the dark color and the occasional rhizoids would seem to remove it from that genus. The somewhat problematical *T. polyacantha* (Hook. f. & Tayl.) from New Zealand might, nevertheless, seem from the published descriptions and figures* to be identical with our species, but a study of the type material in the Taylor Herbarium shows conclusively that this curious plant is distinct not only from *Blepharostoma pilosum* but also from *B. quadripartitum* (Hook.) Trevis., of which Schiffner† has considered it a possible synonym. The New Zealand species is distinguished at once by the numerous paraphylla which clothe the stem and give it a hirsute appearance; they are minute structures, composed of only 2–4 cells and are either simple or forked, their cells, like those of the leaves, being minutely verruculose. Whether the plant is really a *Trichocolea* or not can hardly be settled without a larger supply of material, as the true nature of the involucre cannot be made out without dissection.

In the remarks which supplement Mr. Pearson's description of *Blepharostoma palmatum* Lindb.,‡ a statement is made which would seem to indicate that *B. pilosum* (or some closely allied plant) has sometimes been included under *B. quadripartitum*. The specimens listed below agree closely with authentic specimens of this latter species in the Taylor Herbarium and also with a drawing in the Sullivant collection made from material collected on the Wilkes Expedition. The main differences between the two are the following: *B. quadripartitum* is smaller than *B. pilosum*, and its

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* Lond. Jour. Bot. 3: 290. 1844. Fl. Ant. 1: 161. *pl. 65. f. 9.* 1844.

† Lebermoose der Forschungsreise S. M. S. "Gazelle," 19. 1890.

‡ Jour. Bot. **25**: 193–195. *pl. 275.* 1887.

smaller leaves are less deeply parted (about ⅔), the undivided basal part being about 6 cells across; the leaf-cells are shorter; the leaf-segments are either entire (on slender branches) or sparingly toothed, there being only 1–3 pairs of teeth for each segment, except on the leaf-margins, where there may be 1 or 2 extra ones; the teeth are always short and simple; even on the bracts, where the teeth of the segments are often 6–8 in number on each side, they remain short, rarely being more than 3 or 4 cells in length.

11. BLEPHAROSTOMA QUADRIPARTITUM (Hook.) Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 417. 1877. [Plate 345, figs. 7, 8.]

Jungermannia quadripartita Hook. Musc. Exot. *pl. 117.* 1820.

Temnomia quadripartita Mitt. Jour. Linn. Soc. **15**: 68. 1877.

Jungermannia podophylla Ångstr. Öfversigt af Kongl. Vetensk.-Akad. Förhand. **29**, Häft 4: 11. 1872 (*fide* Pearson).

Fuegia.

12. CHILOSCYPHUS MASSALONGOANUS Steph. Hedwigia, **32**: 325: 1893.

Chiloscyphus fissistipus Massal. Nuovo Gior. Bot. Ital. **17**: 229. *pl. 18. f. 16.* 1885. (Not Hook. f. & Tayl).

Chiloscyphus fissistipus var. *Magellanicus* Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 14. *pl. 2. f. 18.* 1890.

Villarina Bay.

13. FOSSOMBRONIA NAUMANII Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 39, *pl. 7. f. 23–25.* 1890.

Fuegia.

The present material is all sterile and can only be referred provisionally to the above species, from which it differs in certain points. Professor Schiffner has kindly compared the Patagonian plant with the type of *F. Naumanii* from Kerguelen Island and writes me the following note in regard to it: "Differt a *F. Naumanii* statura majore, rhizoidis pallidis (nec violaceo-rubris), absentia squamularum dorsalium. Foliorum forma et reticulatione bene congruit. Aeque ac *F. Naumanii* planta aquatica vel imo palustris esse videtur." In the total absence of reproductive organs it seems wisest not to give our plant a new name.

14. FRULLANIA BOVEANA Massal. Nuovo Gior. Bot. Ital. **17**: 244. *pl. 23. f. 27.* 1885.

Fuegia.

15. HARIOTIELLA HERMITENSIS Massal. & Besch. Nuovo Gior. Bot. Ital. **5**: 256. 1898 (new series).

Polyotus? Hariotianus Besch. & Massal. Bull. Soc. Linn. de Paris, 639. 1886.

Lepidolaena Hariotiana Schiffn. in Engler & Prantl, Nat. Pfl. Fam. **1**^{3}: 110. 1895.

Lapotaia.

16. HARPALEJEUNEA SUBFENESTRATA (Massal.) Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 28. *pl. 6. f. 10, 11.* 1890.

Lejeunea subfenestrata Massal. Nuovo Gior. Bot. Ital. **17**: 249. *pl. 25. f. 30.* 1885.

Villarina Bay.

17. JAMESONIELLA COLORATA (Lehm.) Schiffn. in Engler & Prantl, Nat. Pfl. Fam. **1**^{3}: 83. 1893.

Jungermannia colorata Lehm. Linnaea, **4**: 366. 1829.

Villarina Bay.

18. JUNGERMANNIA ANTARCTICA Ångstr. Öfversigt. af Kongl. Vetensk. Akad. Förhand. **29**, Häft 4: 10. 1872.

Jungermannia Pigafettoana Massal. Nuovo Gior. Bot. Ital. **17**: 217. *pl. 14.* 1885.

Lapotaia.

Through the kindness of Professor Nathorst, of Stockholm, I have been enabled to examine a part of Ångström's type of this species, which is preserved in the collections of the Royal Academy of Science; the specimens agree in all respects with those collected by Dr. Hatcher and also with the published description and figures of *Jungermannia Pigafettoana.* The original description of Ångström does not give an accurate account of the underleaves. In the diagnosis of the species, we read: "amphigastria ovato-vel lanceolato-subulatis;" and, in the fuller description which follows, it is stated: "amphigastria caulis inferioris ovato-subulata, utrinque in parte basali et sub subulam dente uno subulato instructa; in parte superiori caulis lanceolato-subulato subintegra sunt." As a matter of fact, the underleaves are deeply 2-parted, and the description quoted above applies to the divisions and not to the complete structures. Ångström also omits mention of the cuticle of the leaves, which is strongly verrucose, and is one of the most striking peculiarities of the plant.

19. JUNGERMANNIA HATCHERI sp. nov.

Jungermannia barbata, B. Floerkii Gottsche, Die Lebermoose Süd-Georgiens, 450. *pl. 6.* 1890. Not *Jungermannia Floerkii* Web. and Mohr.

Sterile: plants loosely caespitose or creeping over tufts of *Lophocolea rigens*, yellowish-brown; stems simple or sparingly branched, densely radiculose; leaves closely imbricated, obliquely inserted, more or less crispate, broadly quadrate; abruptly widening from the base, not decurrent, cleft one-third or more into 4 obtuse, acute or cuspidate lobes, separated by obtuse or lunulate sinuses, postical margin bearing near the base a cluster of 2–5 fine hair-like cilia, each consisting of 2–8 cells, usually in a single row; underleaves divided almost to the base into 2 slender divisions, bearing cilia in the lower part; leaf-cells rather thin-walled with distinct trigones, cuticle smooth or nearly so; gemmae reddish-brown, borne in chains and forming clusters on the teeth of the upper leaves, angular, composed of 1 or 2 cells.

Stems .5–1 cm. long, 0.35 mm. in diameter; leaves 1.55 mm. long, 1.20 mm. wide; underleaves 0.55 mm. long, 0.15 mm. wide; leaf-cells on margin 15 μ, in the middle 19 μ, and at the base 23 μ in diameter; gemmae 15 μ in diameter. [Plate 346, figs. 1–7.]

Lapotaia.

The present species is an antarctic representative of the *barbatae*-group of the genus *Jungermannia*, a group of closely allied plants, which forms a most conspicuous feature of the hepatic floras of northern and arctic regions. The presence of basal cilia on the leaves shows an approach to *J. lycopodioides* and *J. Floerkii*, and to the latter species the Patagonian plant bears a marked resemblance. The principal points of difference have already been indicated by Gottsche. In *J. Floerkii*, the leaves do not broaden out so abruptly from the base as in *J. Hatcheri*, their lateral margins are more nearly parallel and their more robust basal cilia are often 2 or 3 cells wide in the lower part; the underleaves are much larger and their segments are often 8–10 cells broad at the base instead of only 3 or 4 cells; in *J. Hatcheri*, moreover, the segments end in a single row of 10–20 cells, whereas in *J. Floerkii*, there are usually less than 10 cells. The occasional cuspidate leaf-lobes of *J. Hatcheri* remind one of the similar structures found in *J. lycopodioides*, but this latter species is much more robust, and has longer and more tortuous basal cilia and larger underleaves with broader and more densely ciliated segments.

20. JUNGERMANNIA PROPAGULIFERA Gottsche Die Lebermoose Süd Georgiens, 451, *pl. 1. f. 6–12.* 1890. [Plate 346, figs. 8–18.]

Paroicous: plants caespitose, mixed with the preceding species, yellowish-brown or reddish; stems creeping or ascending, branching by innovations, radiculose: leaves imbricated, ovate-quadrate, obliquely spreading, not decurrent, concave, bifid about one third with subacute sinus and lobes, the antical lobe slightly smaller, otherwise entire (or erose-denticulate from the presence of gemmae); underleaves wanting; leaf-cells polygonal in outline, thin-walled and without trigones; ♀ inflorescence terminal; bracts in 1 or 2 pairs, mostly erect-spreading, similar to the stem-leaves but more crispate, sometimes trifid and with sparingly and irregularly toothed lobes and margins; bracteole connate on one or both sides, with bracts ovate, bilobed or not segmented, toothed or entire; perianth ovate-cylindrical, composed of a single layer of cells, slightly narrowed and plicate in the upper part, minutely denticulate at the mouth: ♂ bracts in 2–4 pairs, situated just below the ♀ bracts, complicate-bilobed, but similar to the stem-leaves when spread out, scarcely inflated at the base and enclosing 1 or 2 antheridia: gemmae borne on the leaves near the apices of the lobes, yellowish-brown, oblong, composed of 1 or 2 cells: capsule spherical, purple, borne on a long hyaline stalk; spores yellowish-brown, minutely tuberculate; elaters reddish, bispiral.

Stems .5–1 cm. long, 0.22 mm. in diameter; leaves 0.95 mm. long and wide; leaf-cells 28 μ in diameter at base, 22 μ in other parts of the leaf; bracts 1.2–1.35 mm. long, 0.85–1.2 mm. wide, bracteole 1.0–1.1 mm. long, 0.5 mm. wide, perianth 2.9 mm. long, 1.1 mm. in diameter; gemmae 20 μ in diameter; spores 12–14 μ in diameter.

Lapotaia.

In his description of *Jungermannia propagulifera*, Gottsche calls attention to the peculiarities of the perigonial bracts and the gemmiparous stems, but says that the perichaetial bracts with the female flowers are still to be desired, thereby implying that the species is dioicous. In other respects the description agrees very closely with the plants collected by Dr. Hatcher, and it seems best to refer the latter's specimens, provisionally at any rate, to Gottsche's species. Curiously enough, both the South Georgian and the Fuegian specimens were found growing with *Jungermannia Hatcheri*. *J. propagulifera* is nearly allied to the European *J. socia* Nees, which certain authors* consider a variety of *J. excisa* Dicks. It resembles this species in its paroicous inflorescence, in its absence of underleaves, etc. In the European species, however, the leaves are less deeply bifid, so that the sinus is obtuse or lunulate, the leaf-cells have thicker walls and there are slight differences in the bracts.

21. LEJEUNEA SAVATIERIANA Besch. & Massal. Bull. Soc. Linn. de Paris, 638. 1886.

Harpalejeunea Savatieriana Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 29. *pl. 6. f. 7.* 1890.

Villarina Bay.

22. LEPICOLEA OCHROLEUCA (Spreng.) Lindb. Acta Soc. Sci. Fenn. **10**: 516. 1875.

Jungermannia ochroleuca Spreng. Syst. Veg. **4**: 325. 1829.

Sendtnera ochroleuca Nees in G. L. & N. Syn. Hep. 240. 1845.

Leperoma ochroleuca Mitt. in Hook. f. Handb. of the N. Zeal. Fl. 754. 1867.

Herberta ochroleuca Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 397. 1877.

Villarina Bay, etc.

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* Cf. Massalongo, Atti della Soc. Veneto-Trent. di Sc. Nat. II. **2**:(19). 1895.

23. LEPIDOLAENA MAGELLANICA (Lam.) Lindb. Jour. Linn. Soc. **13**: 194. 1873.

Jungermannia Magellanica Lam. Encycl. Bot. **3**: 284.

Polyotus Magellanicus Gottsche in G. L. & N. Syn. Hep. 248. 1845.

Gackströmia Magellanica Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 397. 1877.

Fuegia.

24. LEPIDOLAENA MENZIESII (Hook.) Dumort. Recueil d'obs. sur les Jung. 13. 1835.

Jungermannia Menziesii Hook. Musc. Exot. *pl. 118.* 1820.

Polyotus Menziesii Gottsche in G. L. & N. Syn. Hep. 247. 1845.

Fuegia.

25. LEPIDOZIA FILAMENTOSA Lehm. & Lindenb. in G. L. & N. Syn. Hep. 207. 1845.

Jungermannia filamentosa Lehm. & Lindenb. in Lehm. Pugillus, **4**: 29. 1832.

Mastigophora filamentosa Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 416. 1877.

Villarina Bay.

26. LEPIDOZIA PLUMULOSA Lehm. & Lindenb. in G L. & N. Syn. Hep. 211. 1845.

Jungermannia plumulosa Lehm. & Lindenb. in Lehm. Pugillus, **6**: 30. 1834.

Mastigophora plumulosa Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 416. 1877.

Lepidozia tetradactyla Tayl. in G. L. & N. Syn. Hep. 213. 1845.

Jungermannia tetradactyla Hook. f. & Tayl. Lond. Jour. Bot. **3**: 306. 1844.

Fuegia.

27. LEPIDOZIA TRUNCATELLA Nees in G. L. & N. Syn. Hep. 209. 1845.

Mastigophora truncatella Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 416. 1877.

Fuegia.

28. LOPHOCOLEA BIDENTATA (L.) Dumort. Recueil d'obs. sur les Jung. 17. 1835.

Lapotaia.

29. LOPHOCOLEA STENOPHYLLA Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. Gazelle, 12. *pl. 3. f. 25–28.* 1890.

Villarina Bay.

30. LOPHOCOLEA HORIZONTALIS (Hook.).

Jungermannia horizontalis Hook. Musc. Exot. *pl. 96.* 1818.

Chiloscyphus horizontalis Nees in G. L. & N. Syn. Hep. 177. 1845.

Jungermannia grandifolia Hook. f. & Tayl. Lond. Jour. Bot. **3**: 474. 1844.

Chiloscyphus grandifolius Tayl. in G. L. & N. Syn. Hep. 185. 1845.

Villarina Bay.

31. LOPHOCOLEA LENTA (Hook. f. & Tayl.) Tayl. in G. L. & N. Syn. Hep. 162. 1845.

Jungermannia lenta Hook. f. & Tayl. Lond. Jour. Bot. **3**: 379. 1844.

Jungermannia diademata Hook. f. & Tayl. *l. c.* **3**: 560. 1844.

Jungermannia secundifolia Hook. f. & Tayl. *l. c.* **3**: 471. 1844.

Lapotaia.

32. LOPHOCOLEA OBVOLUTA (Hook. f. & Tayl.).

Jungermannia obvoluta Hook. f. & Tayl. Lond. Jour. Bot. **4**: 80. 1845.

Fuegia.

In the original description of this species no station is given except the Falkland Islands. In the Flora Antarctica, Hermite Island, Cape Horn, is also mentioned. Under the name *Jungermannia obvoluta*, two plants are preserved in the Taylor herbarium; the first of these from the Falkland Islands, must be considered the type of the species; the second from Cape Horn, is apparently distinct, but there is so little of it that it would be unwise to attempt to describe it. In the type-specimen a well-developed leaf is almost longitudinally inserted and is attached by a very broad base, the distance from side to side being about twice as great as that from base to apex. The leaf is more or less distinctly divided into two unequal lobes; the postical, which is slightly the larger, is concave and rounded at the base and extends beyond the stem, at the apex it is bidentate but is otherwise entire; the antical lobe is decurrent and is irregularly lobed and dentate. The leaf-cells average 25 μ in diameter. The specimens collected on the Albatross expedition and referred by the writer to *L. abvolutaeformis*[*] agree closely with this type. In Dr. Hatcher's specimens the postical lobe is more coarsely and irregularly dentate than in the type and the leaf-cells are a little smaller, averaging 21 μ in diameter, but the plants are otherwise so similar that they can hardly be separated. It it probable that *Lophocolea obvolutaeformis* (De Not.) Massal. also belongs here, although the published descriptions[†] of this species differ from Taylor's specimen in a few minor details. The figure of *L. obvoluta* in the Flora Antarctica does not well represent the species.

33. LOPOHOCOLEA PALLIDE-VIRENS (Hook f. & Tayl.) Mitt. Jour. Linn. Soc. **15**: 72. 1877.

Jungermannia pallide-virens Hook f. & Tayl. Lond. Jour. Bot. **3**: 473. 1844.

Chiloscyphus pallide-virens Tayl. in G. L. & N. Syn. Hep. 179. 1845.

Villarina Bay.

34. LOPHOCOLEA PUCCIOANA (De Not.) Massal. var. SUSPECTA Massal. Nuovo Gior. Bot. Ital. **17**: 228. *pl. 17. f. 1–9.* 1885.

Villarina Bay.

Prof. Massalongo has kindly confirmed my determination of these specimens. In the Sullivant collection there is a drawing labeled "*Jungermannia humilis*" which was made from specimens collected by the Wilkes Expedition. The drawing represents a plant which is identical with Dr. Hatcher's specimens. As, however, *Jungermannia humilis* Hook. f. & Tayl.* seems to have been a composite species and as Mitten† has applied the name to a plant without underleaves, it seems wisest not to change the name of De Notaris' plant. *Jungermannia humilis* is apparently not represented in the Taylor herbarium.

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[*] Contr. U. S. Nat. Herb. **1**: 140. 1892.

[†] Mem. Acc. Tor. II. **16**: 220. *f. 8*, 1855. Nuovo Gior. Bot. Ital. **17**: 223. 1885.

35. LOPHOCOLEA RIGENS (Hook. f. & Tayl.).

Jungermannia rigens Hook. f. & Tayl. Lond. Jour. Bot. **3**: 461. 1844.

Dioicous: densely caespitose, yellowish-green; stems ascending and giving off numerous simple or subdivided, ascending or erect, lateral branches, sparingly radiculose, the radicles in clusters at the bases of the underleaves: leaves imbricated, obliquely inserted, erect-spreading, strongly concave or convolute (especially on the branches), broadly ovate or orbicular, bifid about one-fourth with acute, obtuse or lunulate sinus and acute teeth, otherwise entire, more or less decurrent at antical base: underleaves ovate, bifid one-third or more with narrow sharp lobes, usually bearing on each side a small tooth at about the middle, otherwise entire: leaf-cells polygonal, thin-walled, slightly or not at all thickened at the angles: ♀ inflorescence terminal, sometimes innovating, bracts in 2 or 3 pairs, less obliquely inserted and slightly larger than the leaves but scarcely different from them in shape; bracteole ovate, bifid about one-third and bearing a small tooth on each side above the middle; perianth (young) campanulate, 3-keeled but without wings, 3-lobed at the wide, open mouth and coarsely and irregularly toothed: ♂ inflorescence borne in the course of a branch, bracts in several (about 5) pairs, imbricated and convolute, similar in shape to the stem-leaves when spread out but expanding at the antical base into an inflated pouch usually tipped with a tooth; underleaves not modified.

Stems .5–1 cm. long, 0.2 mm. in diameter; leaves (large) 0.75 mm. long and wide; underleaves (large) 0.35 mm. long, 0.3 mm. wide; leaf-cells at edge of leaf 16 μ, in middle 21 μ and at base 25 μ in diameter; perichaetial bracts 1 mm. long, 0.85 mm. wide, bracteole 0.95 mm. long, 0.7 mm. wide; perigonial bracts 0.7 mm. long, 0.5 mm. wide.

Lapotaia.

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* Lond. Jour. Bot. **3**: 468. 1844.

† Botany of Kerguelen Island: Transit of Venus Expedition, 34. 1874.

This distinct little *Lophocolea* does not seem to have been recorded since its original discovery in the Falkland Islands. Dr. Hatcher's specimens agree very closely with the sterile type material in the Taylor herbarium, and I have given a full account of the species because the original description is far from complete and the figure given in the Flora Antarctica does not adequately represent the plant. Fruiting stems seem to be very rare, the plant apparently spreading by means of small branches, which, when dry, easily become detached.

The authors of *Jungermannia rigens* compared it with the European *J. Francisci* Hook. and, in the Synopsis, it is placed close to that species; the position of the branches, however, which are produced near the postical basal angle of the subtending leaves would at once remove it from the genus *Cephalozia* in which *J. Francisci* is now included. *L. rigens* belongs in the puzzling group of *Lophocoleae* with bifid leaves. Its small size and yellowish-green color, the curious rolling up of its leaves, which often gives the branches a worm-like appearance and the slight modifications which its bracts undergo will serve to distinguish it.

36. LOPHOCOLEA VASCULOSA (Hook. f. & Tayl.) Nees in G. L. & N. Syn. Hep. 702. 1847.

Jungermannia vasculosa Hook. f. & Tayl. Lond. Jour. Bot. **3**: 461. 1844.

Jungermannia elata Gottsche, Die Lebermoose Süd-Georgiens, 450. *pl. 7. f. 3–6.* 1890.

On trees, Cordilleras of Patagonia.

The figures of this species in the Flora Antarctica give a false idea of the underleaves, which are much narrower than is represented. The quoted illustration of *Jungermannia elata*, however, is more accurate in this respect. The Patagonian plants agree closely with the types of *J. vasculosa* in the Taylor Herbarium.

37. MARCHANTIA POLYMORPHA L. Sp. Pl. 1137. 1753.

Cordilleras of Patagonia: Fuegia.

Although the species of *Marchantia* which were collected during the Antarctic voyage were identified by Hooker and Taylor as *M. polymorpha*, they were afterwards referred by Mitten to *M.*

tabularis Nees.* I had hoped to find the latter species in the present collection, but a study of numerous specimens and a comparison with an authentic African plant of *M. tabularis*,† kindly sent me by Herr Stephani, have shown conclusively that Dr. Hatcher's material of this genus is all referable to *M. polymorpha*.

38. MARSUPIDIUM CRYSTALLINUM (Massal.) Besch. & Massal. Compt. rend. de la Miss. Sc. du Cap Horn, **5**: 229. 1889.

Gymnanthe crystallina Massal. Nuovo Gior. Bot. Ital. **17** 239. *pl.* 22. *f.* 24. 1885.

Acrobolbus excisus Schiffn. in Engler & Prantl, Nat. Pfl. Fam. **1**^{3}: 86. 1893.

Fuegia.

The material of this species is all sterile, and is present in small amount. My determination has been kindly verified by Prof. Massalongo. It is doubtful if the plant can be retained in *Marsupidium*, as we now understand that genus.

39. MARSUPIDIUM URVILLEANUM (Mont.) Mitt. in Hook. f. Handb. N. Zeal. Fl. 754. 1867.

Plagiochila Urvilleana Mont. Ann. des Sc. Nat. II. **19**: 247. 1843.

Scapania Urvilleana Mont. in G. L. & N. Syn. Hep. 63. 1844.

Jungermannia Urvilleana Hook. f. & Tayl. Lond. Jour. Bot. **3**: 468. 1844.

Gymnanthe Urvilleana Tayl. in G. L. & N. Syn. Hep. 193. 1845.

Acrobolbus Urvilleanus Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 423. 1877.

Jungermannia abbreviata Hook. f. & Tayl. Lond. Jour. Bot. **3**: 374. 1844.

Plagiochila abbreviata Tayl. in G. L. & N. Syn. Hep. 646. 1847.

Fuegia.

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* Hook. f. Handb. N. Zeal. Fl. 545. 1867.

† According to Schiffner (Oesterr. botan. Zeitschrift. 1896), *Marchantia tabularis* Nees is a synonym of the older *M. Berteroana* Lehm. & Lindenb.

40. METZGERIA FRONTIPILIS Lindb. Acta Soc. pro Faun. et Flor. Fenn. **1**: 14. *f. 2.* 1877.

Fuegia.

41. MYLIA ABDITA (Sulliv.).

Plagiochila abdita Sulliv. in Hook. Jour. Bot. and Kew Gard. Misc. **2**: 317. 1850.

Leioscyphus pallens Mitt. Jour. Linn. Soc. **15**: 68. 1877.

Lapotaia.

The type of *Plagiochila abdita* is not to be found at present in the Sullivant Herbarium, but there is a drawing of the species there, which agrees very closely with the Lapotaia specimens and also with the published descriptions and figures* of *Leioscyphus pallens.* The two genera, *Mylia* and *Leioscyphus* (or *Leptoscyphus*), are both given places by Schiffner† in his recent treatment of the genera of Hepaticae. He recognizes, however, that they are very close to each other and points out only two, purely vegetative, characters to distinguish them: in *Mylia* the leaves are said to be *alternate* and the underleaves *undivided;* whereas in *Leioscyphus*, the leaves are said to be *opposite* and the underleaves *bifid.* The first distinction, however, does not hold, as there are acknowledged species of *Leioscyphus* (*e. g.*, *L. chiloscyphoideus*) with alternate leaves; and the second distinction seems hardly sufficient to separate the genera.

42. MYLIA CHILOSCYPHOIDEA (Lindenb.).

Plagiochila chiloscyphoidea Lindenb. in Lehmann, Pugillus, **8**: 4. 1844.

Leioscyphus chiloscyphoideus Mitt. Fl. Tasmaniae, **2**: 225. 1860.

Feugia.

43. PIGAFETTOA CRENULATA Massal. Nuovo Gior. Bot. Ital. **17**: 237. *pl. 21. f. 23.* 1885.

Villarina Bay.

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* Mitten, Botany of Kerguelen Island: Transit of Venus Expedition, *pl. 3. f. 6.* 1874. Schiffner and Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," *pl. 3. f. 4, 5.* 1890.

† Engler & Prantl, Nat. Pfl. Fam. 1^3: 89, 90. 1893.

44. PLAGIOCHILA ANSATA Hook. f. & Tayl. in G. L. & N. Syn. Hep. 649. 1847. [Plate 347.]

Jungermannia ansata Hook. f. & Tayl. Lond. Jour. Bot. **3**: 457. 1844.

Plagiochila circinalis var. Besch. & Massal. Bull. Soc. Linn. de Paris, 627. 1886.

Dioicous: plants growing in loose tufts, blackish-brown varying to pale brown or yellowish-green: stems simple or sparingly branched, sometimes innovating from below the perianth, slightly or not at all radiculose: leaves distant or subimbricated, erect-spreading or erect and appressed to the stem, orbicular-obovate, rounded at the broad apex, cuneate at the base, margin entire or repand, the antical decurrent, the postical rounded near the base and less decurrent: underleaves wanting: leaf-cells polygonal (mostly 6-sided), becoming elongated toward base, trigones very conspicuous, separated by narrow thin-walled regions or pits: ♀ inflorescence terminal, the bracts in 2 or 3 pairs, passing by gradual transitions into the stem-leaves, the margins coarsely and irregularly dentate with 1–5 sharp teeth or blunt projections, innermost bracts narrower than the others, ovate or obovate in shape; perianth long-exserted, flattened, exalate, clavate, very gradually narrowed toward the base and truncate at the apex, mouth bilabiate, ciliate-dentate, perianth 2 cells thick except close to the base where it is 3 cells and near the mouth where it is only one cell.

Stem 5 cm. or more long, 0.25 mm. in diameter; leaves 1.5 mm. long, 1.4 mm. wide; leaf-cells on edge of leaf 25 μ, in the middle 29 μ and at the base 53 μ × 29 μ; bracts of innermost row 1.5 mm. × 0.95 mm. and 1.7 mm. × 1.35 mm., perianth 4 mm. long, 1.2 mm. wide.

Villarina Bay.

Plagiochila ansata is a species of wide distribution in southern regions, having been reported also from the Falkland Islands and from New Zealand. The type specimens from the first of these localities agree closely with the Fuegian plants; but, as the published descriptions and figures of the species are somewhat inadequate, it has seemed advisable to describe and figure it anew. The description given above is drawn from robust stems, particularly those bearing perianths; sterile stems and the branches and innovations of fertile plants are sometimes much more slender and bear scattered and smaller leaves. Even in the most slender forms, however, the characteristic leaf-cells with their well-developed trigones are retained. Judging from the description, the specimens doubtfully referred by Bescherelle and Massalongo to *Plagiochila circinalis* belong here. Herr Stephani has kindly sent me a specimen of the last-named species from Australia; and, although it is certainly a near ally of *P. ansata*, it differs from it in the following points: the plants are more robust, the leaves are densely imbricated and their antical margins spread out from the stem and are strongly revolute throughout nearly their whole length, the leaf-cells are scarcely, if at all, elongated at the base, their trigones are even more conspicuous, they are oval or circular in outline and are very frequently confluent.

45. PLAGIOCHILA BISPINOSA Lindenb. Ann. Sci. Nat. IV. **8**: 326. *pl. 11. f. 7–13.* 1858.

Villarina Bay.

46. PLAGIOCHILA DURICAULIS Hook. f. & Tayl. in G. L. & N. Syn. Hep. 641. 1847.

Jungermannia duricaulis Hook. f. & Tayl. Lond. Jour. Bot. **3**: 458. 1844.

Fuegia.

47. PORELLA FOETENS (De Not.) Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 407. 1877.

Madotheca foetens De Not. Mem. Acc. Tor. II. **16**: 231. *f. 17.* 1855.

Villarina Bay.

48. RADULA FLAVIFOLIA Tayl. in G. L. & N. Syn. Hep. 259. 1845.

Jungermannia flavifolia Hook. f. & Tayl. Lond. Jour. Bot. **3**: 476. 1844.

Fuegia.

49. SCHISTOCHILA GAYANA (Gottsche) var. MASSALONGOANA (Schiffn. & Gottsche).

Gottschea Gayana var. Massal. Nuovo Gior. Bot. Ital. **17**: 205. *pl. 12. f. 2.* 1885.

Gottschea Gayana var. *Massalongoana* Schiffn. & Gottsche, Lebermoose der Forschungsreise S. M. S. "Gazelle," 2. 1890.

Villarina Bay.

50. SCHISTOCHILA LAMELLATA (Hook.) Dum. Recueil d'obs. sur les Jung. 15. 1835.

Jungermannia lamellata Hook. Musc. Exot. *pl. 49.* 1818.

Gottschea lamellata Nees in G. L. & N. Syn. Hep. 20. 1844.

Villarina Bay.

51. SCHISTOCHILA LAMINIGERA (Hook. f. & Tayl.) Evans, Contr. U. S. Nat. Herb. **1**: 141. 1892.

Jungermannia laminigera Hook. f. & Tayl. Lond. Journ. Bot. **3**: 456. 1844.

Gottschea laminigera Tayl. in G. L. & N. Syn. Hep. 623. 1846.

Fuegia.

52. TRICHOCOLEA TOMENTOSA (Swartz) Gottsche in G. & R. Hep. Eur. Exs. no. *272*.

Jungermannia tomentosa Swartz, Prod. Fl. Ind. occ. 145. 1788.

Jungermannia tomentella var. *tomentosa* Lindenb. Hep. Eur. 19. 1829.

Trichocolea tomentella var. *tomentosa* G. L. & N. Syn. Hep. 237. 1844.

Leiomitra tomentosa Lindb. Acta Soc. Sci. Fenn. **10**: 515. 1875.

Basichiton tomentosum Trevis. Mem. reale Ist. Lomb. di Sci. e Lett. III. **4**: 394. 1877.

Fuegia.

53. TYLIMANTHUS ANDERSSONII (Ångstr.). [Plate 348.]

Jungermannia tenella Ångstr. Öfversigt af Kongl. Vetensk. Akad. Förhand. **29**, Häft 4: 11. 1872. (Not Hook f. & Tayl.).

Gymnanthe Anderssonii Ångstr. l. c. **33**, Häft **4**: 50. 1876.

Dioicous: growing in loose tufts or mixed with other hepaticae, pale or whitish-green: plants consisting of a prostrate caudex giving rise to ascending or erect stems: caudex radiculose, usually bearing scattered rudimentary leaves: stems without rhizoids or with a few scattered ones close to the caudex, simple or sparingly branched, sometimes giving off radiculose stolons from the lower part; stem-leaves distant and rudimentary below, more or less imbricated and larger above, obliquely inserted, somewhat concave, obovate-orbicular from a narrowed base, antical margin decurrent, straight or slightly curved, entire, postical margin reaching nearly to middle of stem, slightly or not at all decurrent, entire, sinuate, or with a few scattered teeth, apex broad and variable, sometimes distinctly emarginate-bilobed, with acute, obtuse or rounded lobes, sometimes truncate, entire or sparingly and irregularly dentate with blunt teeth; underleaves wanting; leaf-cells thin-walled with small but distinct trigones, somewhat elongated toward base, cuticle smooth: ♀ inflorescence terminal on short ascending stems or elongated branches; bracts crowded, similar to the leaves, but even more irregular in shape, sometimes unequally 2-lobed, the innermost narrower and more delicate than the others and sometimes more conspicuously toothed, sac tapering to a blunt point, radiculose: ♂ inflorescence borne in the course of ascending stems, bracts in about five pairs, imbricated, strongly saccate below, but with spreading apices above, broadly orbicular when explanate, truncate or emarginate-bifid, the postical lobe being the larger.

Stems 1.5–3 cm. long, 0.35 mm. in diameter; leaves 1.7 mm. long, 1.85 mm. broad; leaf-cells at base 58 μ long, 29 μ broad, in other parts of the leaf 29 μ in diameter; outer perichaetial bracts 1.9 mm. long and broad, sac 2.7 mm. long, 1 mm. in diameter; perigonial bracts 1 mm. long, 1.45 mm. wide. The foregoing measurements may be considered representative of this very variable species.

Lapotaia.

In its pale color and in the shape and areolation of its leaves, the present plant strongly resembles *Marsupidium Urvilleanum*, which is a more robust species with its leaves more strongly dentate and inflexed on their antical margins. As far as can be judged from descriptions, the two species differ from each other in the position of the ♀ inflorescence and pendant sac, necessitating their separation into distinct genera. In *Marsupidium Urvilleanum*, this sac is described by Mitten* as "attached to the lower part of the stem by its side;" in the closely related (if not identical) *M. Brecknockiense* (Massal.) Besch. and Massal., its author† says: "perichaetia ad ramorum basim et in ramulo brevissimo sublaterali radicante posita"; in the species described above, on the contrary, the sac is clearly terminal on ascending stems or elongated branches, showing that the plant is a *Tylimanthus*. The sac moreover has the same structure as that ascribed to this genus—its wall is closely adherent to the calyptra and it bears a cluster of unfertilized archegonia at its mouth. At my request Professor Nathorst has kindly sent me some of the original specimens of *Gymnanthe Anderssonii* as determined by Ångström. So far as can be decided from sterile plants, these belong to the same species as Dr. Hatcher's specimens, although in some of them the leaves are a little more toothed.

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* Handb. N. Zeal. Fl. 754. 1867.

† Nuovo Gior. Bot. Ital. 17: 214. 1885.

YALE UNIVERSITY.

Explanation of Plates.

PLATE 345. *Blepharostoma pilosum* Evans. 1. Plants, natural size. 2. Part of stem, antical view (× 32). 3. Leaf (× 32). 4. Leaf subtending branch (× 32). 5. Underleaf (× 32). 6. Cells from middle of leaf (× 290). *Blepharostoma quadripartitum* (Hook.) Trevis. 7. Leaf (× 32). 8. Perichaetial bract (× 32).

PLATE 346. *Jungermannia Hatcheri* Evans. 1. Plant, natural size. 2. Part of gemmiparous stem, antical view (× 16). 3, 4. Leaves (× 16). 5, 6. Underleaves (× 28). 7. Cells from middle of leaf (× 255). *Jungermannia propagulifera* Gottsche. 8. Plants, natural size. 9. Part of stem with ♂ and ♀ inflorescence, antical view (× 16). 10. Part of stem with perianth, antical view (× 16). 11. Leaf (× 16). 12. Cells from middle of leaf (× 255). 13, 14. Innermost perichaetial bracts, 13 with connate bracteole (× 16). 15. Bract of next outer row (× 16). 16, 17. Perigonal bracts (× 16); 13–17 from one inflorescence. 18. Innermost perichaetial bracts with connate bracteole between them, from another inflorescence (× 16).

PLATE 347. *Plagiochila ansata* Hook. f. & Tayl. 1. Plants, natural size. 2. Part of stem with perianth, lateral view (× 15). 3. Part of sterile stem, lateral view (× 15). 4. Cells from middle of leaf (× 290). 5, 6, 7. Bracts, in regular order from perianth (× 15). 8. Transverse section of perianth (× 18). 9. Teeth from mouth of perianth (× 290).

PLATE 348. *Tylimanthus Anderssonii* (Ångstr.) Evans. 1. Plants, natural size. 2. Sterile stem, postical view (× 12). 3. Female stem with two young sacs (× 12). 4. Female stem with mature sac (× 12). 5. Male stem, antical view (× 12). 6. Cells from middle of leaf (× 220). 7, 8, 9. Perichaetial bracts (× 12). 10. Perigonial bract (× 14).

A Revision of the Genera Chloris and Eustachys in North America.

BY GEORGE V. NASH.

Most recent authors have united these two genera, and, while they do bear certain resemblances, we have come to the conclusion, after a careful examination of all the material at our disposal, that they are much better treated as genera than as two sections of one genus. The resemblances are those which are, in great part, common to all the genera of the tribe *Chlorideae*, that is, they both have one-sided spikes with the spikelets sessile and alternately arranged in two rows. These are their most marked resemblances, and, as intimated above, are not peculiar to either genus. The compressed culms and sheaths are common to both, but much more manifest in *Eustachys*. The details of the spikelet, however, present differences which seem to justify their separation. The general make-up of the spikelet is essentially the same as it is in all the related genera, but in the forms of some of its parts peculiarities appear which can be relied upon for generic distinction. It is true that in a few rare instances in *Chloris* the awn of the third scale is very short, but in the great majority of the species the awn is distinctly manifest, and in a large number of them it is very long. In *Eustachys*, on the contrary, the awn of the third scale is hardly manifest, and usually less than 1 mm. long, often but a mere point, and frequently entirely wanting. The few short-awned forms of *Chloris* can be at once distinguished from *Eustachys* by the second empty scale, which in this latter genus is broad and of approximately the same width from the base to the apex which is at least truncate, and usually 2-toothed or 2-lobed and distinctly awned. In *Chloris* both the empty scales are lanceolate or narrowly ovate, hence with the sides converging at the acute or acuminate apex, and in a few species the midnerve is continued as a short point. In all the material examined this distinctive character of the second scale is constant, and this, in the case of *Eustachys*, in conjunction with the more flattened culms and sheaths and the strongly equitant character of the latter at the base of the culms, together with the absence of the awn in the third scale, or, when present, its extreme shortness, appear to us to warrant the maintenance of *Eustachys* as distinct from *Chloris*. In general appearance the two groups are readily distinguishable, thus adding confirmatory evidence to the technical characters above alluded to.

In North America, the distribution of the two genera is markedly different. *Chloris*, with the exception of one species, *C. barbata*, does not occur native east of the Mississippi River. This one exception is in southern peninsular Florida and is a West Indian plant which is also found in South America. *Eustachys*, on the other hand, with one exception, *E. petraea*, is not indigenous west of the Mississippi, but is mainly confined to the southeastern United States. *E. petraea* extends as far west as Texas, and much beyond the limits of North America. *Chloris* appears to be abundant in the southwestern United States and Mexico, and probably southward into South America, while *Eustachys*, as stated above, is mainly confined, in the United States, to the southeastern portion, and is particularly partial to Florida, all four species being found in that State, two of them not known outside its borders, and one species, *E. Floridana*, extending just beyond the line into Georgia. The fourth species, *E. petraea*, as stated, has a wider range, extending from Florida along the Gulf Coast to Texas, and thence through Central America to South America; also in the West Indies and the Bahamas.

Descriptions follow of the two genera with the species under them and their distribution, so far as known, at the present time. In order that the knowledge of this distribution may be extended and better defined, additional herbarium material would be highly prized, and the hope is expressed that those having such material to spare will send it to the author, who will gladly determine it.

The material, upon which the results obtained in this paper are based, is contained in the herbaria of the New York Botanical Garden, Columbia University, and the Division of Agrostology, at Washington, D. C., and also in the author's own private collection. The material from the herbarium of the Division of Agrostology, kindly loaned for examination by Prof. Scribner, has been of especial value and has greatly aided us in this revision, as it is particularly rich in forms from Texas and the adjacent country, in which region the genus *Chloris* is largely represented.

CHLORIS Sw. Prod. 25. 1788.

Tufted annual or perennial sometimes glaucous grasses with round or more or less compressed smooth and glabrous culms and sheaths, flat or folded obtuse or acute leaves, and terminal inflorescence composed of erect or spreading 1-sided spikes arranged usually in a terminal whorl, or sometimes with the addition of a whorl or two, or of several scattered spikes, very rarely single. Spikelets alternately arranged in 2 rows on one side of a triangular rachis and more or less divergent from it. Scales 4–9, the awns hispidulous; outer 2 scales empty, membranous, keeled, 1-nerved, the nerve hispidulous, the first scale acute, shorter than the second which is acute or acuminate and sometimes awn-pointed; third scale firmer, chartaceous, keeled, 3-nerved, the nerves usually more or less pilose, or rarely the midnerve glabrous or hispidulous only, awned, the awn usually manifest, sometimes very long, the scale enclosing a perfect flower and a 2-nerved palet as long as the scale or a little shorter, the nerves ciliolate; fourth scale of various and characteristic shapes, similar in texture to the third, awned, from acute to truncate at the summit which is usually inrolled, 3–7-nerved, generally empty, rarely enclosing a shorter palet and flower; the remaining scales successively smaller and empty. Stamens 3. Styles distinct; stigmas plumose. Grain free, linear to elliptic, nearly round or 3-sided.

A genus of about 40 species, widely distributed in all warm or tropical regions, excepting those of Europe. Some of the species are cultivated for ornament, but none appear to be of economic value or importance.

In general appearance the species bear much resemblance to each other, but the technical characters separating them, while confined to small organs and requiring careful dissection, are wonderfully constant. In several closely related species the fourth scale has been found to be of great importance. Its shape and particularly the formation of the apex have proved of especial value. The venation of this scale has also furnished characters for separating species of close affinities. While usually 3-nerved, it is sometimes 5- or 7-nerved above the middle by the branching of the lateral nerves at that place, the branches being sometimes faint but readily discernible on close inspection.

The genus has two fairly marked groups, one with the base of the slender racemes naked or furnished with but few scattered spikelets, the other with the spikelets crowded to the very base of the stouter and usually shorter racemes. The essential and diagnostic details of the two groups will be found in the following key:

Key to the Species.

Spikes slender, usually naked at the base or with a few scattered spikelets.
  Mid-nerve of the third scale not pilose, but hispidulous above the middle. 1. *C. Nealleyi.*
  Nerves of the third scale all pilose.
    Apex of the elliptic fourth scale acute. 2. *C. tenuispica.*
    Apex of the obovate-cuneate fourth scale obliquely truncate. 3. *C. verticillata.*
Spikes stout, spikelet-bearing to the base.
  Hairs on the nerves of the third scale short, .5 mm. or less long, not manifest and not extending beyond the apex of the scale.
    Fourth scale obovate-cuneate, 3-nerved, .6 mm. wide, the apex unequally rounded. 4. *C. brevispica.*
    Fourth scale obcuneate or triangular, 5-nerved, 1 mm. or a little more broad. 5. *C. latisquamea.*
    Fourth scale broadly triangular, 7-nerved, wider than long. 6. *C. cucullata.*
  Hairs on the lateral nerves of the third scale long, 1 mm. or more in length, manifest and decidedly extending beyond the apex of the scale.
    Hairs on the lateral nerves of the third scale about equal in length.
      Hairs exceeding the apex of the scale, about 1 mm. long; fourth scale 1 mm. wide; upper surface of the leaves glabrous. 7. *C. Texana.*
      Hairs much exceeding the apex of the scale, 2–3 mm. long; fourth scale .5 mm. wide; upper surface of the leaves near the base usually long-hairy. 8. *C. barbata.*
    Hairs on the lateral nerves of the third scale unequal in length, those at the summit much longer.
      Scales 4, rarely 5; third scale one third as broad as long, the terminal hairs on the lateral nerves 2.5–3 mm. long. 9. *C. elegans.*
      Scales 7–9, the upper ones much reduced; third scale one sixth as broad as long, the terminal hairs on the lateral nerves about 1 mm. long. 10. *C. Prieuri.*

1. CHLORIS NEALLEYI nom. nov.

Chloris Texensis Nash, Bull. Torr. Bot. Club, **23**: 151. 1896. Not *C. ciliata* var. *Texana* Vasey. 1890.

Culms 3–6 dm. tall, compressed, tufted, simple, or branched at the base, erect; nodes 2: culm leaves about 2; sheaths usually longer than the internodes, smooth, compressed, keeled; ligule a scarious ciliolate ring about .5 mm. broad; blades 2.5–15 cm. long, 3–5 mm. wide, smooth beneath, rough above and on the margins: inflorescence exserted; spikes 5–8, 10–18 cm. long, pilose at the base which is naked or with a few scattered spikelets: spikelets, exclusive of the awns, about 4 mm. long: scales 4; outer empty scales often purplish, acuminate, the first scale three fourths as long as the second which is about 3.5 mm. long; third scale, exclusive of the awn, 4 mm. long, in side view equilateral and .8 mm. wide, acute, the internerves rough, especially above the middle, the callus pilose, the lateral nerves pilose above the middle, the hairs increasing in length toward the apex, the midnerve hispidulous above the middle, the awn inserted just below the apex, 6–9 mm. long, the palet as long as the scale; fourth scale 2–2.5 mm. long, in side view elliptic and about .5 mm. wide, the apex acute, the lateral nerves glabrous, the midnerve hispidulous above the middle, the awn inserted just below the apex, 4–5 mm. long.

Texas. Collected by both G. C. Nealley and F. W. Thurow, and apparently only by them. The larger third and fourth scales, together with the glabrous midnerve of the former and the different shape of the latter, readily separate this from *C. verticillata* Nutt. The collection by Mr. Nealley is taken as the type.

2. CHLORIS TENUISPICA sp. nov.

Culms 2–4 dm. tall, erect, tufted, compressed, simple or somewhat branched at the base, the innovations about one half as long as the culms; nodes 3 or 4: culm leaves 3 or 4; sheaths overlapping, compressed, keeled; ligule a scarious ciliolate ring about 1 mm. wide; blades 4–15 cm. long, 2–3 mm. wide, linear, abruptly acute, smooth beneath and often with a few scattered hairs arising from papillae, rough above and on the margins: inflorescence with the axis 2 cm. or less long, angled, the angles hispidulous; spikes 10–12, 6–10 cm. long, finally widely spreading, in about two whorls, very slender, pilose at the base, which is naked or with a few scattered spikelets: spikelets, exclusive of the awns, about 3 mm. long; scales usually 4, sometimes 5, the outer empty ones narrow, acuminate, awn-pointed, the first scale about three fourths as long as the second, which is 3–3.5 mm. long; third scale with the callus pilose, about 3 mm. long, in side view elliptic, equilateral and .7 mm. wide, the lateral nerves pilose their entire length, the midnerve to the base of the awn, which is inserted just below the acute apex and is 4–6 mm. long, the palet slightly shorter than the scale; fourth scale sparingly pilose on the midnerve only, occasionally enclosing a perfect flower (and in this case the scale a little larger than usual), similar to the third, though smaller, usually empty, somewhat inequilateral in side view, the margins more curved than the midnerve, which is almost straight, the lateral nerves but little more curved than the midnerve, 1.75–2 mm. long, in side view about .5 mm. wide, acute at the apex, the awn inserted just below the apex, 2.5–4 mm. long; fifth scale, when present, less than 1 mm. long with an awn shorter than itself.

Texas. Resembles in general appearance and in its outer empty scales *C. verticillata*, but its narrower leaves, very slender spikes, and the acutish and not truncate fourth scale readily distinguish it. The fourth scale occasionally bearing a flower and maturing seed is a character not noted in any other species. It is at once known from *C. Nealleyi* by the smaller third scale with its pilose midnerve.

The type material was collected by Mr. G. C. Nealley in 1889. It was also secured by him the following year. Mr. S. B. Buckley collected it in 1883, and Mr. J. G. Smith secured it at Alice, on June 7, 1897, no. 4.

3. CHLORIS VERTICILLATA Nutt. Trans. Am. Phil. Soc. II. **5**: 150. 1833–37.

Culms 2–5 dm. tall, compressed, at first erect, at length decumbent at the base and rooting at the lower nodes, simple or somewhat branched; nodes of the erect part of the culm 1–4: leaves 1–several; sheaths compressed, keeled, overlapping, a few long hairs on each side at the apex, the uppermost one much elongated; ligule a scarious ciliolate ring about .5 mm. wide; blades 1.5–18 cm., usually less than 8 cm., long, 2–4 dm. broad, smooth beneath, rough above and on the margins, linear, obtuse: inflorescence at length exserted, the axis .5–5 cm., usually 2–3 cm., long, angled, the angles hispidulous; spikes 8–21, commonly exceeding 12, 5–15 cm. long, generally more than 10 cm., pilose at the base which is usually naked or with a few scattered spikelets, at length widely spreading, arranged in 1–4 whorls, or the upper ones scattered or approximate, the rachis hispidulous on the back: spikelets, exclusive of the awns, about 3 mm. long: scales 4, with rarely the minute rudiment of a fifth scale; outer empty scales acuminate, awn-pointed, the first scale from two thirds to three fourths as long as the second which is about 3 mm. long; third scale pilose on the callus, 2.5–2.75 mm. long, in side view nearly equilateral and .8 mm. wide, the lateral nerves pilose their entire length with short hairs, the midnerve as far as the awn, which is inserted just below the apex and is 5–8 mm. long, the palet as long as the scale; fourth scale 1.5–2 mm. long, in side view obovate-cuneate and about .75 mm. wide, inequilateral, the midnerve straight, the lateral nerves much curved, the apex obliquely truncate with the marginal corner rounded, thus making the extranerval portion crescent-shaped, the awn inserted at or just below the apex, 4–5 mm. long.

Sandy soil, Arkansas to Kansas, south to Texas. In the herbarium of Columbia University is preserved a specimen of Nuttall's collection in Arkansas.

The following are to be referred here:

Kansas: Ulysses, C. H. Thompson, June 27, 1893, no. 55.

Indian Territory: Between Fort Cobb and Fort Arbuckle, Palmer, 1868, no. 396. Sapulpa, B. F. Bush, June 19, 1894, no. 779; Redfork, June 21, no. 780; Claremore, Sept. 18, no. 783.

Oklahoma: M. A. Carlton, June, 1891, no. 210. Stillwater, J. Hayes Bone, 1896, no. 30.

Texas: Dallas, J. Reverchon, June, no. 3440**.

4. CHLORIS BREVISPICA sp. nov.

Chloris verticillata var. *intermedia* Vasey; L. H. Dewey, Contr. U. S. Nat. Herb. **2**: 528. In part. 1894. Not *C. intermedia* A. Rich. 1851.

Culms 1–2 dm. tall, compressed, decumbent at the base, at length somewhat branching; nodes 2 or 3: culm leaves 2 or 3; sheaths compressed, shorter than the internodes, keeled; ligule a scarious ciliolate ring less than 1 mm. long; blades 1–6 cm. long, 1–3 mm. wide, erect or ascending, smooth beneath, rough above and on the margins: inflorescence consisting of 6–10 finally spreading spikes, spikelet-bearing to the base, 2.5–4.5 cm. long: spikelets, exclusive of the awns, about 2.8 mm. long; scales 4: outer empty ones lanceolate, acute, usually tinged with purple, the first scale a little more than one half as long as the second which is about 2 mm. long; third scale 2.5 mm. long, in side view about equilateral, elliptic and about .75 mm. wide, the callus pilose, the midnerve sparingly pilose with short hairs to the awn, the lateral nerves more copiously nearly to the apex, the hairs about .5 mm. long, the awn inserted a little below the apex, about 2 mm. long, the palet equaling the scale; fourth scale obovate-cuneate, about 1.5 mm. long, in side view about .6 mm. wide, the midnerve almost straight, the lateral nerves considerably curved, the apex unequally rounded, the extranerval portion crescent-shaped, the awn inserted below the apex, 1.4–1.8 mm. long.

Sandy soil, Texas. Readily distinguished from *C. verticillata* by its shorter and less numerous spikes, broader empty scales, shorter awns, and smaller and differently shaped fourth scale.

The following specimens belong here:

G. C. Nealley, 1885; Hockley, F. W. Thurow, 1891; Nueces Co., A. A. Heller, 1894, Mar. 21, no. 1471 (the type), and Gregory, April 14, no. 1579.

5. CHLORIS LATISQUAMEA nom. nov.

Chloris verticillata var. *intermedia* Vasey; L. H. Dewey, Contr. U. S. Nat. Herb. **2**: 528. In part. 1894. Not *C. intermedia* A. Rich. 1851.

Culms 2–6 dm. tall, compressed, simple at first, finally branched at the decumbent base and rooting at the lower nodes; nodes 2 or 3: culm leaves 2 or 3; sheaths usually much shorter than the internodes, compressed, keeled; ligule a scarious ciliolate ring less than 1 mm. wide; blades 1–10 cm. long, 2–4 mm. wide, linear, obtuse, rough on both surfaces and on the margins: inflorescence exserted, the axis 1.5 cm. or less long, angled, the angles hispidulous; spikes 10–16, 3–7 cm. long, finally widely spreading and often more or less flexuous, spikelet-bearing to the base: spikelets, exclusive of the awns, 2.3–2.8 mm. long; scales 4; outer empty ones acute, the first scale about one half as long as the second, which is about 2 mm. long; third scale 2.2–2.7 mm. long, in side view elliptic and .8–.9 mm. broad, about equilateral, the callus pilose, the lateral nerves strongly pilose their entire length with short hairs, the midnerve less so to the base of the awn, which is inserted just below the apex and is 1.5–3 mm. long, the palet about as long as the scale; fourth scale 1.5–1.7 mm. long, in side view obcuneate or rarely triangular and 1–1.2 mm. broad, 3-nerved, the midnerve straight, the lateral nerves much curved, branching at the middle, thus making the scale appear 5-nerved at the truncate apex, the extranerval portion triangular, .5 mm. wide, the awn inserted just below the apex, 1.5–2 mm. long.

Dry ground and shady river banks, Texas. Distinguished from *C. verticillata* by the shorter spikes, shorter and broader outer empty scales, and the broader and more nerved fourth scale; the different shape and the much greater width of this latter organ, together with its much more spreading awn, also serving to separate it from *C. brevispica*, to which it is closely related.

The following specimens are referred here:

Houston, Elihu Hall, April 20, 1872, no. 773; San Diego, Miss Mary B. Croft, 1884, no. 60a; Del Rio, G. C. Nealley, 1892; Fort Clark, Kinney Co., Edgar A. Mearns, 1892, Dec. 3, no. 1233, and 1893, April 29, no. 1424; A. A. Heller, 1894, Gregory, San Patricio Co., April 14, no. 1580, and Kerrville, Kerr Co., May 14–21, no. 1767 (the type); Kerrville, J. G. Smith, June 21, 1897.

The *C. verticillata* var. *intermedia* of Vasey, judging from what we take to be the original material, comprises two well-marked forms. This material is in the National Herbarium and consists of three sheets on which are written, presumably in the handwriting of Dr. Vasey, these words: "Intermediate between *cucullata* and *verticillata*." No definite indication of what was considered the type occurs on any one of the sheets and in fact a varietal name is not indicated. The plants on one of the sheets above referred to were collected by F. W. Thurow, at Hockley, Texas, in 1891, and belong to the preceding species. The other two sheets, the specimens of which were collected, on one by G. C. Nealley, in Texas, and on the other by Elihu Hall, at Houston, in the same state, in 1872, no. 773, have been referred here. Dr. Vasey, so far as can be ascertained, never published such a variety himself. Mr. L. H. Dewey, however, as indicated in the synonymy above, did publish a variety *intermedia* and accredited its authorship to Vasey, but as this is invalidated by the *C. intermedia* of A. Richard, as previously shown in the synonymy, the lack of definite information as to just what is the type loses much of its importance. On account of this impossibility of identifying the type of the variety, we have thought it best, in order that authentic material of what we have above designated as *C. latisquamea* may be accessible to a large number of herbaria, to take as the type of this new species material from some large collection which is widely distributed, not only in this country, but also in Europe. Mr. A. A. Heller's no. 1767, collected at Kerrville, Kerr Co., Texas, May 14–21, 1894, seems best to serve this purpose.

6. CHLORIS CUCULLATA Bisch. Ann. Sci. Nat. III. **19**: 357. 1853.

Chloris verticillata var. *aristulata* Torr. Pac. R. R. Surv. Pope's Rep. **2**: Bot. 176. 1855.

Culms 2–7 dm. tall, compressed, erect, or later decumbent a the base and rooting at the lower nodes; nodes of the erect culm 2 or 3: culm leaves 2 or 3; sheaths compressed, keeled, loosely embracing the culm, much shorter than the internodes, usually rough on the keel; ligule a scarious ring 1 mm. or less broad; blades 2–15 cm. long, 3 mm. or less wide, erect or nearly so, flat, or folded when dry, very rough on both surfaces: inflorescence consisting of 6–15 spikes, usually 8–10, 2–4 cm. long, often flexuous, widely spreading, spikelet-bearing to the base: spikelets, exclusive of the awns, 1.7–2 mm. long, triangular, about as broad as long: scales 4; first scale acute, one half to three fifths as long as the second which is 1.5–1.75 mm. long and broader above the middle; third scale 1.7–2 mm. long, in side view elliptic and about .9 mm. wide, nearly equilateral, obtuse, the callus pilose, the lateral nerves densely pilose their entire length with short hairs about .4 mm. long, the midnerve sparingly so, the awn inserted just below the apex, .5–1 mm. long, the palet about as long as the scale; fourth scale about 1 mm. long, in side view broadly triangular and 1.3 mm. broad, the midnerve slightly curved, the lateral nerves branching twice, making the scale appear 7-nerved above, the awn inserted just below the apex .2–.3 mm. long: seed elliptic, about 1.3 mm. long, finely striate.

Sandy soil, Texas. At once distinguished from all other species by its very broad 7-nerved fourth scale.

The following specimens are referred to this species:

Lindheimer, 1847, no. 730. Austin, Elihu Hall, 1872, no. 776. Upper Brazos, J. Reverchon, Sept., 1879, no. 1148; also at Seymour, Sept., no. 3440*. San Diego, Miss Mary B. Croft, 1884, no. 60. Laredo, C. G. Pringle, July 24, 1889, no. 2405. Austin, J. E. Bodin, Sept., 1891, no. 292. Corpus Christi, Nueces Co., A. A. Heller, March 14–21, 1894, no. 1449. R. T. Hill, 1895, no. 86.

7. CHLORIS TEXANA (Vasey).

Chloris ciliata var. *Texana* Vasey, Bull. U. S. Dept. Agric. Div. Bot. **12**^{1}: 30. 1890.

Culms 2.5–6 dm. tall, simple, slender, compressed; nodes about 3: culm leaves about 3; sheaths much shorter than the internodes, coarsely striate; ligule a scarious ciliolate ring about .5 mm. broad; blades 6–20 cm. long, 3–6 mm. wide, flat, ascending, rough on the margins and toward the apex on the lower surface, otherwise smooth: inflorescence finally exserted; spikes 3–6, 4–8 cm. long, erect or nearly so, spikelet-bearing to the base: spikelets, exclusive of the awns, about 2.8 mm. long: scales 6; outer empty ones very acute, pointed, the first scale about three fifths as long as the second, which is 2.5–3 mm. long; third scale, with the callus pilose, about 2.7 mm. long, in side view inequilateral and 1 mm. broad, the margin much more curved than the midnerve, the nerves pilose with hairs about 1 mm. long, which extend beyond the apex of the scale, the lateral nerves except at the base and the apex, the midnerve up to the awn, which is inserted just below the apex and is about 1.5 mm. long, the palet about as long as the scale; fourth scale about 1.7 mm. long, in side view obovate-cuneate and 1 mm. wide at the truncate and obscurely crenulate apex, 3-nerved, the midnerve almost straight, the lateral nerves much curved, the extranerval portion broadly triangular, the awn inserted just below the apex, 1–1.25 mm. long, the palet about three-fifths as long, narrow, the nerves ciliolate; fifth scale similar to the fourth, 1 mm. long, in side view .8 mm. wide; sixth scale about .5 mm. long.

Southern Texas. Apparently collected only by G. C. Nealley at Brownsville in 1889. Occurs also in the West Indies. Ricksecker's no. 42, collected at St. Croix, D. W. Indies, on Nov. 4, 1895, belongs here.

This, as indicated above, has been considered a variety of *C. ciliata* Sw., but according to our conception of that species, based upon the descriptions of its author, this must be quite different. In the original place of publication of *C. ciliata*,* Swartz does not give a very extended description, and if this were the only source from which to draw the result would be rather dubious, but in his subsequent work on the flora of the West Indies † a much longer and more definite description is given, with a reference to the first place of publication. In this latter work the sheaths are said to be villous at the throat, and the third scale with an awn twice its length and the hairs as long as the scale. In *C. Texana*, as will be noted above, the ligule is a mere ciliolate scarious ring which could hardly be called villous under any conception of that term, and the third scale has the awn much shorter than itself and the hairs longer than the scale. What the *C. ciliata* of Swartz is we do not know, no material that could be properly referred there having come under our observation. About the name which we have adopted for this plant, *C. Texana*, there can be no doubt as the type has been seen.

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* Prod. 25. 1788.

† Fl. Ind. Occ. 1: 197. 1797.

8. CHLORIS BARBATA (L.).

Andropogon barbatum L. Amoen. Acad. **5**: 412. 1759. Not of Mant. 302. 1767.

Andropogon polydactylon L. Sp. Pl. 1483. 1763. [Ed. 2.]

Chloris polydactyla Sw. Prod. 26. 1788.

Culms 5–10 dm. tall, round or slightly flattened; nodes 3 or 4: culm leaves 3 or 4; sheaths striate, the lower ones overlapping, the upper shorter than the internodes; ligule a scarious ciliolate ring about 1 mm. broad; blades 6 dm. or less long, 1 cm. or less wide, attenuate into a long slender point, smooth on both surfaces, rough on the margins, usually densely pilose on the upper surface at the base, just above the ligule, with hairs 3–4 mm. long: inflorescence at length long-exserted; spikes 6–25, usually a dozen or more, flexuous and more or less spreading, 5–15 cm. long, commonly more than 10 cm.: spikelets, exclusive of the awns, about 3 mm. long: scales 6; outer empty ones acuminate, the first scale about three fourths as long as the second (which is about 3 mm. long) and broader; third scale, with the callus short-pilose, about 2.25 mm. long, in side view inequilaterally elliptic and about .75 mm. wide, the nearly straight midnerve much less curved than the lateral nerves, all the nerves pilose, the midnerve to above the middle with hairs about .5 mm. long, the lateral nerves from below the middle to the apex with intermixed hairs of irregular length 2–3 mm. long, the hairs extending much beyond the apex of the scale, the brown awn inserted just below the summit, 3–4 mm. long, the palet about as long as the scale; fourth scale about 1.3 mm. long, in side view obovate-elliptic and about .5 mm. wide, obliquely truncate at the crenulate apex, the brown awn inserted just below the summit, 2.5–3 mm. long; fifth scale triangular, a little more than one half as long as the fourth; sixth scale about one half as long as the fifth; grain elliptic, about 1 mm. long.

South peninsular Florida. Also in the West Indies and South America. Collected in this country, so far as indicated by the material at our disposal, only by Mr. J. H. Simpson.

A word in regard to the history of the name of this plant may be of interest. Linnaeus in the Amoenitates Academicae,[*] in an article on the plants of Jamaica, published an *Andropogon barbatum* giving a fairly long description and the following citation: "Brown, jam. 364." We have not access to the work cited by him, but from the description there can be little doubt as to what plant he had in view. In a later work, however, he throws more light upon the subject in the publication of his *Andropogon polydactylon*,† citing as synonymous his previous publication in the Amoenitates, further elucidating the matter by again referring to "Brown, jam. 364," and adding a positive means of identification in his additional reference to "Sloan, jam. 33, hist. 1, p. 111, t. 65, f. 2." This plate and description have been seen by us, and there is no doubt as to the figure representing what has long been called *Chloris polydactylon* Sw., the long leaves and the elongated flexuous spikes, characteristic of this species, being well indicated.

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[*] 5: 412. 1759.

An examination of the above facts will show that Linnaeus included in the publication of his *Andropogon polydactylon* a reference to his previous publication of *Andropogon barbatum*, with its reference to the work on Jamaica by Brown, thus fully establishing the fact of the identity of the two plants, and as confirmatory evidence offers the plate in Sloan's History of Jamaica which, as stated above, well represents the *Chloris polydactyla* Sw. It would seem from this that a clear case is established for the adoption of the name *barbatum* for this species, as it antedates the other by four years.

Just why Linnaeus should have proceeded in this apparently careless manner is not clear. A hint as to where he secured the name *polydactylon* is given in the words he cites in the second edition of his Species Plantarum: "Andropogon polydactylon assurgens, spicis tenuioribus hirsutis. Brown, jam. 364." Why he should thus ignore the earlier publication of *Andropogon barbatum* and substitute for the specific name that of *polydactylon*, we must repeat, is not clear. Possibly he thought that *polydactylon* was a better descriptive term, as the numerous long spikes of the plant are very striking.

Subsequent to the publication of his *Andropogon polydactylon*, Linnaeus again published an *Andropogon barbatum*,* giving its habitat as the East Indies, but making no reference whatever to the publication of his first species of this name. This, of course, makes this subsequently published name a homonym, and necessitates securing another name for the East Indian plant, a result which can probably be attained by delving among the mass of little understood names in this genus.

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† Sp. Pl. Ed. 2: 1483. 1763.

* Mant. 302. 1767.

9. CHLORIS ELEGANS H.B.K. Nov. Gen. & Sp. Pl. **1**: 166, *pl. 49.* 1815.

Culms 1.5–9 dm. tall, compressed, erect, finally branched; nodes 2–4: culm leaves 2–4; sheaths compressed, keeled, much shorter than the internodes, loosely embracing the culm, the uppermost one much enlarged at the time of protrusion of the inflorescence; ligule a scarious ciliolate ring 1 mm. or less wide; blades 1–20 cm. long, usually less than 10 cm., 2–6 mm. wide, erect or ascending, smooth beneath, usually very rough above: inflorescence yellowish or silvery white, often tinged with purple, consisting of 3–12, commonly 8–10, erect spikes, 2–8 cm. long: spikelets, exclusive of the awns, about 4 mm. long, long-hairy at the base: scales 4, or occasionally 5; outer empty ones lanceolate, often purplish, acuminate, the first scale about three fifths as long as the second which is about 3 mm. long and bears just below the apex an awn about 1 mm. long; third scale, exclusive of the awn, 3–3.5 mm. long, pilose on the callus, in side view equilateral and about 1 mm. wide, the midnerve abruptly contracted a short distance below the awn, glabrous or more or less pilose with short hairs except at the summit, the marginal nerves nearly equally curved, short pilose below the middle, long pilose at the summit with erect hairs 2.5–3 mm. long, which much exceed the apex of the scale, the internerves below the middle and near the midnerve sometimes sparingly appressed-pubescent, the awn inserted just below the summit, 5–10 mm. long, the palet about as long as the scale; fourth scale 1.5–2.5 mm. long, in side view about .6 mm. wide and obcuneate to oblong-cuneate, obliquely truncate at the apex, the midnerve nearly straight or a little curved, the lateral nerves curved from about the middle to the apex, the awn inserted just below the summit, 3–7 mm. long; fifth scale, when present, triangular, less than 1 mm. long: seed elliptic, 1.75 mm. long.

Sandy soil. Texas to Arizona, south to Central America.

The following, among many specimens examined, are to be referred here:

New Mexico: C. Wright, 1851–2, nos. 2026 and 2027.

Arizona: J. T. Rothrock, 1874, no. 578. Gardiner's Spring, C. G. Pringle, June 24, 1882. Fort Huachuca, T. E. Wilcox, 1891, no. 79. Tucson, J. W. Toumey, Aug. 25, 1891, no. 150.

Mexico: Chihuahua, C. G. Pringle, Sept. 20, 1885, no. 474.

10. CHLORIS PRIEURI Kth. Enum. Pl. **1**: 266. 1833.

Culms 4–10 dm. tall, at first erect, finally decumbent at the base and rooting at the lower nodes; nodes 4–6: culm leaves 4–6; sheaths shorter than the internodes, keeled, at least toward the summit, smooth, papillose-hirsute on both margins at the summit, otherwise glabrous; ligule a scarious ciliolate ring, about .5 mm. broad; blades 1.5 dm. or less long, 3–6 mm. wide, smooth beneath, rough above and on the margins, the upper surface papillose-hirsute toward the base with long hairs: inflorescence at length exserted; spikes 4–15, 6–9 cm. long, erect, the rachis strongly hispid, especially on the angles: spikelets, exclusive of the awns, about 4 mm. long: scales 7–9, the upper ones much the smaller, the uppermost scale often reduced to a mere awn; outer empty scales acuminate, awn-pointed, the first about one half as long as the second, which is 2.5–3 mm. long; third scale, exclusive of the awn, 3–3.5 mm. long, in side view narrowly oblong and about .5 mm. broad, acute, the callus short-pilose, a row of dark glands on each side of the glabrous midnerve, the lateral nerves glabrous below the middle, pilose above, the hairs increasing in length toward the summit, where they are about 1 mm. long, the awn inserted just below the apex, 8–15 mm. long, the palet shorter than the scale, gland-bearing between the nerves; remainder of the scales much reduced in size, sometimes mere rudiments, the awns successively shorter.

Introduced at Wilmington, N. C., and on ballast at Mobile, Ala., collected at the former place by Mr. G. McCarthy, and at the latter locality by Dr. Chas. Mohr.

EUSTACHYS Desv. Nouv. Bull. Soc. Philom. **2**: 188. 1810.

[SCHULTESIA Spreng. Pl. Pugill. **2**: 17. 1815.]

Tufted perennial sometimes glaucous grasses with much compressed smooth and glabrous culms and sheaths, the former often 2-edged, the latter crowded at the base of the culm and strongly equitant, leaves flat, or, when dry, folded, obtuse, and a terminal inflorescence composed of erect or ascending 1-sided spikes, digitately arranged in 1 or occasionally in 2 whorls, or rarely reduced to 1 or 2 spikes. Spikelets alternately arranged in 2 rows on one side of a triangular rachis and more or less divergent from it. Scales 4, or very rarely 5, the fifth rudimentary, the awns, when present, hispidulous; outer 2 scales empty, membranous, keeled. 1-nerved, the nerve hispidulous, the first scale acute or acutish, shorter than the awned second, which is broad and oblong, 2-toothed or 2-lobed, or sometimes truncate, at the apex; third scale firmer, chartaceous and deep brown or almost black at maturity, keeled, 3-nerved, the nerves pilose, awnless or bearing a mere rudimentary awn, enclosing a perfect flower and a 2-nerved palet as long as or a little shorter than the scale, the nerves ciliolate; fourth scale similar in texture to the third, awnless or rarely short-awned, rounded to truncate at the apex, which is inrolled on the margins, 3-nerved, the nerves glabrous. Stamens 3. Styles distinct; stigmas plumose. Grain free, elliptic.

Species about 10, confined to the tropics and the warmer parts of the temperate zones in America.

Key to the Species.

- Spikelets 2 mm. long; third and fourth scales awnless, or the former with a mere dorsal point.
  - Spikes usually 4–6, rarely more; second scale of the spikelet manifestly 2-toothed at the apex; leaves usually 3–7 mm. wide. 1. *E. petraea.*
  - Spikes 10–25; second scale of the spikelet truncate at the apex; leaves usually 1 cm. or more wide. 2. *E. glauca.*
- Spikelets 3 mm. or more long; third and fourth scales awned.
  - Spikes usually 1 or 2, rarely 3; third scale of the spikelet exceeding 3 mm. long. 3. *E. Floridana.*
  - Spikes 4–6; third scale of the spikelet less than 3 mm. long. 4. *E. neglecta.*

1. EUSTACHYS PETRAEA (Sw.) Desv. Nuov. Bull. Soc. Philom. **2**: 189. 1810.

Chloris petraea Sw. Prod. 25. 1788.

Chloris Swartziana Doell, Mart. Fl. Bras. **2**^{3}: 68. 1883.

Culms 3–11 dm. tall, much compressed, at length branched, often decumbent or prostrate at the base and rooting at the lower nodes; nodes 2–5: basal leaves crowded, culm leaves 2–4 at the lower nodes; sheaths much compressed, keeled, striate, those at the base and lower nodes equitant; ligule a scarious ciliolate ring less than .5 mm. wide; blades 3 dm. or less long, usually under 2 dm., 10 mm. or less wide, commonly 6 mm. or under, smooth on both surfaces, rough on the margins: inflorescence at length much exserted, consisting of 3–11, usually 4–6, erect or slightly spreading spikes, 4–11 cm. long: spikelets about 2 mm. long:

scales 4; outer empty ones broad, the first scale acute, from one half to three fourths as long as the second, which, exclusive of the awn, is 1.5–1.75 mm. long, oblong, more or less hispidulous on the exterior surface, 2-toothed at the apex, the teeth triangular, acute or obtusish, the awn about .5 mm. long; third scale, with the callus pilose, about 2 mm. long, in side view elliptic and about 1 mm. wide, nearly equilateral, the midnerve a little more curved than the lateral nerves, all the nerves pilose with hairs about .3 mm. long, the lateral nerves from just below the middle to the apex, the midnerve excepting at the base and the summit, the awn a mere point, or wanting, the palet about as long as the scale; fourth scale 1.3–1.5 mm. long, in side view obovate-elliptic, .5–.7 mm. wide, rounded at the apex, awnless.

Dry sandy soil, usually along the coast, North Carolina to Florida, west to Texas. Also in Cuba and the Bahamas and in Central and South America. In Florida it occurs in the heart of the peninsula, 50 miles from the coast.

The following specimens are to be referred here:

Texas: Corpus Christi, H. W. Ravenel, Apr. 30, 1869, no. 86. Hempstead, Elihu Hall, Apr. 18, 1872, no. 775.

Florida: A. H. Curtiss, Jacksonville, May, no. 3443; June 12, 1893, no. 4060; and Aug. 23, 1894, no. 4808. Eustis, Lake Co., Geo. V. Nash, March 12–31, 1894, no. 217.

Bahama Islands: Fortune Island, Eggers, no. 3860.

Cuba: C. Wright, no. 3817.

2. EUSTACHYS GLAUCA Chapm. Fl. South. U. S. 557. 1860.

Chloris glauca Vasey, Descrip. Cat. Grasses U. S. 61. 1885.

Culms 6–15 dm. tall, much compressed, sometimes sparingly branched, usually simple; nodes 2–4: basal leaves 6–12, culm leaves 2–4 at each of the nodes, excepting the uppermost one; sheaths much compressed, equitant, keeled, broadest at the base, striate; ligule a scarious ciliolate ring about .5 mm. wide; blades 2.5 dm. or less long, 1.5 cm. or less wide, linear, rounded at the apex, smooth on both surfaces, rough on the margins, the uppermost one wanting or less than 1 cm. long: inflorescence finally long-exserted, the axis 2.5 cm. or less long; spikes 10–25, erect or somewhat spreading, 6–15 cm. long: spikelets about 2 mm. long: scales 4; first scale boat-shaped, acute, about one half as long as the second, which, exclusive of the awn, is 1.5 mm. long, oblong, in side view about .3 mm. wide, minutely and irregularly toothed at the truncate apex, hispidulous on the outer surface, the awn about .3 mm. long; third scale 1.75–2 mm. long, in side view about equilateral, ovate, .8–.9 mm. wide, obtuse at the awnless apex, the nerves hispid above the middle, the hairs shorter toward the apex of the scale, the palet about as long as the scale; fourth scale about 1.3 mm. long, in side view oblong and about .5 mm. wide, rounded-truncate at the awnless apex.

Brackish marshes and along cypress swamps, Florida.

The following belong here:

Jacksonville, A. H. Curtiss, Sept., no. 3444; Sept. 23, 1893, no. 4059, and Sept. 18, 1894, no. 5186. Eustis, Lake Co., Geo. V. Nash, July 1–10, 1895, no. 2139.

3. EUSTACHYS FLORIDANA Chapm. Fl. South. U. S. 557. 1860.

Chloris Floridana Vasey, Descrip. Cat. Grasses U. S. 61. 1885.

Culms 4–10 dm. tall, erect, simple, much compressed; nodes 2: culm leaves 2; sheaths much compressed, keeled, much shorter than the internodes, those at the base short and crowded, the uppermost one elongated; ligule a scarious ciliolate ring about .5 mm. broad; blades folded, at least when dry, erect, rough on the margins, smooth on both surfaces, acute, the early basal ones 1–3 dm. long, 4–8 mm. wide, those on the culm 2–7 cm. long, 5 mm. or less wide, the terminal one minute or wanting: inflorescence long-exserted, consisting of 1–3, usually 2, rarely 3, erect spikes, 5–10 cm. long: spikelets, exclusive of the awns, 3–3.5 mm. long: scales 4; first scale obtuse or acutish, about two thirds as long as the second, which is about 2.5 mm. long, exclusive of the awn, minutely pubescent on the outer surface, unequally 2-lobed at the apex, the lobes rounded and minutely and irregularly toothed, the awn .7–1 mm. long; third scale, with the callus pilose, 3–3.5 mm. long, in side view nearly equilateral and 1–1.2 mm. wide, elliptic, the midnerve with a slight depression near the apex, the marginal nerves more curved, all the nerves pubescent with ascending hairs about .5 mm. long, the lateral nerves excepting at the base, the midnerve except at the apex, the awn .5–.7 mm. long, inserted just below the apex, the palet about as long as the scale; fourth scale 1.5–2.5 mm. long, in side view nearly oblong, a little broader at the rounded-truncate summit, 1 mm. wide, 3-nerved, the awn inserted just below the apex, less than .5 mm. long: seed obtusely 3-angled, about 2.3 mm. long.

Dry sandy soil, southern Georgia and northern Florida.

The following belong here:

Georgia: Bainbridge, Chapman.

Florida: Lake City, Columbia Co., Geo. V. Nash, July 11–19, 1895, no. 2198. Chattahoochee, S. M. Tracy, Aug. 23, 1897, no. 3730.

4. EUSTACHYS NEGLECTA.

Chloris neglecta Nash, Bull. Torr. Bot. Club, **22**: 423. 1895.

Culms 7–12 dm. tall, erect, simple, much compressed; nodes 3: basal leaves 6–12, culm leaves usually 1 at each node, sometimes 2 at the lower node; sheaths much compressed, keeled, striate, the basal equitant; ligule a scarious ciliolate ring about .5 mm. broad; blades folded, at least when dry, 2 dm. or less long, 9 mm. or less wide, linear, obtuse, smooth on both surfaces, rough on the margins, the uppermost wanting or very small: inflorescence at length much exserted, the axis less than 1 cm. long; spikes 4–6, erect or slightly spreading: spikelets, exclusive of the awns, about 3 mm. long: scales 4, rarely 5; first scale obscurely 2-lobed at the apex, awn-pointed between the lobes, a little broader than, and about two thirds as long as, the second, which, exclusive of the awn, is about 2.5 mm. long, oblong, sparsely pubescent exteriorly, 2-lobed at the apex, the lobes obtuse and minutely and irregularly toothed, the awn about 1 mm. long; third scale, with the callus pilose, 2.5–2.8 mm. long, in side view about 1 mm. wide and a little inequilateral, the margin more curved than the midnerve, the nerves pilose with hairs about .7 mm. long, the lateral nerves excepting at the base, the midnerve to the base of the awn, which is about 1 mm. long, the palet slightly shorter than the scale; fourth scale 1.5–2 mm. long, in side view obovate-elliptic and about .75 mm. wide, the awn inserted below the summit, less than 1 mm. long; fifth scale, when present, triangular, less than .5 mm. long: seed 3-angled, elliptic, about 1.5 mm. long.

Dry sandy soil, east and peninsular Florida. The type of this species was collected by the writer near Orange Bend, Lake Co., in 1895, no. 2149. The greater number of spikes, the smaller spikelets, and the shorter third scale with its longer hairs at once distinguish this from the above, *E. Floridana*, to which, in general appearance, it bears much resemblance.

The following belong here:

Jacksonville, A. H. Curtiss, 1875. Duval Co., bank of St. John's river, A. Fredholm, Oct. 9, 1893, no. 319. Eustis, Lake Co., Geo. V. Nash, July 1–10, 1895, no. 2149 (the type).

New Plants from New Mexico.—III.

By E. O. Wooton.

Commelina crispa.

Much branched, perennial by tuberous roots (erect when young, lower part of stem prostrate, upper erect in age): stems often 5–8 dm. long, finely villous-pubescent above, especially on stems near the nodes, becoming glabrous below: leaves linear-lanceolate, 3–7 cm. long, 4–6 mm. wide, pubescent with small scattering hairs on both surfaces, acuminate, crispate, slightly contracted at the base; ochrea 12–15 mm. long, membranous, closed all the way up, supplied with several white bristly hairs on the margin at the mouth of its tube; spathe much the shape of that of *C. Virginica* L. but slightly shorter, a little broader and the sides more curved, 1.5–2 cm. long, 1 cm. broad, acute, decurrent into a peduncle 5–8 mm. long, pubescent and also bearing some weakly hispid rather long white hairs at the base, generally about 3-flowered: sepals all broadly elliptical-rotund, the upper one slightly narrower than the others (3 mm. long) and only about half as large: two upper petals broadly reniform, long-clawed, 1–1.5 cm. in diameter, very delicate in texture and finely veined, bright blue; claw 3–4 mm. long; third petal small, white, lanceolate, 2–3 mm. long: 3 fertile stamens with 7–9 mm. long filaments; 3 staminodia about half as long: style over 1 cm. long, loosely coiled upward: pod 3-celled and 3-seeded, glabrous, two of the cells dehiscent, the third indehiscent: seeds orbicular, slightly flattened, smooth.

Collected at the base of the Organ Mountains, Doña Ana Co., Sept. 1; altitude 4800 feet, no. 545. Much if not all the southwestern material which has been referred to *C. Virginica* belongs here. In reality this plant is more closely allied to *C. angustifolia* than to *C. Virginica.*

It is one of the common species of the Southwest, as is shown by the fact that it was collected by Pope's expedition and Marcy's and the Mexican Boundary Surveyors. Its range seems to be from the plains of western Nebraska and Kansas southward into Mexico, particularly in the arid region. I have found it growing only in loose rocky soil.

PHILADELPHUS ARGYROCALYX.

Branching shrub, 1–2 m. high, with slender branches, bark red-brown on the younger stems, shreddy on the older ones: leaves opposite, elliptical-ovate, 2–3.5 cm. long, 7–12 mm. broad, acute, contracted into a short petiole, glabrate above, appressed-pubescent and lighter green below, strongly 3-nerved, entire: flowers solitary, terminating short leafy branches, bright white, about 3 cm. in diameter: calyx-tube hemispherical, 3–5 mm. in diameter; limb 4-parted, segments ovate, acute, short-acuminate, 4–6 mm. long, the whole calyx with the peduncle densely silvery white, woolly over the outside and at the tips within; petals 4, obovate, retuse to obcordate: stamens numerous, of several lengths: anthers greenish: styles united; stigmas linear, slightly longer than styles; ovary perfectly glabrous: fruit a 4-celled coriaceous pod with numerous seeds, inclosed in the persistent woolly calyx.

Collected on Eagle Creek, in the White Mountains, Lincoln Co., Aug. 14, 1897, in fruit, no. 524, at an altitude of about 7000 feet. First collected in flower on Ruidoso Creek in the same mountains, June 30, 1895, at about the same altitude. Also collected at Fort Huachuca, Ariz., June, 1892, and July, 1893, by Dr. T. E. Wilcox.

It is most closely allied to *P. microphyllus* Gray, having about the same sized flowers and leaves, but is easily separated from that species by its calyx. In *P. microphyllus* the calyx is slightly pubescent at the base on the outside, but most of the tube and all the outside of the limb is perfectly glabrous. *P. serpyllifolius* Gray has the woolly calyx but its flowers and leaves are not one third the size of those of *P. argyrocalyx*.

LINUM VERNALE.

Annual or biennial (?) herb, 2–3 dm. high with numerous erect stems from a whitish perpendicular root about 1 dm. long: stems slightly curved at the base, branched above, terete, slightly striate, perfectly glabrous: leaves numerous and closely imbricated on the lower part of the stems, more scattered above, 7–18 mm. long, barely 1 mm. wide at the base, linear-subulate, obscurely 1-nerved, glabrous, bluish-green, lower entire, upper glandular-dentate; stipular glands very small and blackish: flowers numerous, borne on pedicels 5–15 mm. long and apparently opposite the leaves: sepals rather broadly lanceolate, 5–7 mm. long, 1.5–2 mm. wide, scarious-margined and glandular-dentate with numerous fine teeth.

= L. Berlandieri [illegible]!

subaristate, with one prominent central vein and two lateral ones, persistent in fruit: petals broadly obovate-cuneate, 12–15 mm. long, 10–12 mm. broad, golden yellow, with a brownish-red blotch at the base forming an "eye" to the flower, early deciduous and very delicate: stamens slightly shorter than the 7 mm. long almost completely united styles: capsule a little shorter than the sepals, ovoid; callus at base of proper septa very small, false septa hardly complete, thickened only a little at the very base.

My specimens of this plant come from a single locality—the base of a small mountain, generally called Tortugas, standing alone on the mesa about five miles east of Las Cruces, Doña Ana, Co. in dry soil. I collected it in flower Apr. 22, 1893, and several times about the same season at this place. A few specimens were taken there in fruit July 1, 1897, no. 589.

Thurber's no. 561 from El Paso, Texas, in bloom April, 1851, and labeled *L. rigidum* Pursh., M. E. Jones' no. 3721 from El Paso, Texas, April 17, 1884, also in flower and labeled *L. Boottii.* Planchon, as well as some Mexican Boundary specimens without data but labeled *L. Berlandieri* Hook., are all to be referred here

The flowers and habit show our plant to be related to *L. Berlandieri* and *L. multicaule.* It is separated from the former by narrow leaves, smaller and more numerous flowers, persistent sepals and very slightly thickened false septa. From *L. multicaule* it is distinguished by a more erect habit, more numerous flowers, leaves not crowded above, plant glabrous throughout and sepals glandular-dentate.

Our plant has possibly been included with *L. aristatum* Engelm. but can hardly belong there if Dr. Engelman's description of the plant is to be relied upon for our plant is rarely one foot high, has flowers which are not at all sulphur yellow and sepals which surpass the pod but a very little.

The fact that our plant seems to bloom in the spring, a season at which the other species of the genus of that section are not likely to be in flower, has been of especial interest and attention is called to the fact in the name now proposed.

MARTYNIA PARVIFLORA.

Coarse, rank-scented clammy viscid annual: stems decumbent, ascending at the ends, 1 m. or more long, branching at the base, very viscid-glandular: leaves opposite, broadly ovate in general outline, obscurely 5-lobed, cordate, coarsely sinuate, obtuse; petiole 7–15 cm. long; blade in young plants 5–8 cm. long, 4–6 cm. broad, in well-developed plants the largest leaves frequently 2 dm. long and three-fourths as broad: flowers in racemes which are borne in the angle between the dichotomous branches; pedicels 1–2 cm. long, becoming longer and stouter and strongly reflexed in fruit: calyx bibracteolate, unequally 5-lobed, cleft to the base on the outer side, the inner segment being narrowest and longest, 12–14 mm. long, lobes rather obtuse, narrowly ovate to lanceolate, strongly veined and very glandular; bracts oblong-lanceolate, 6–7 mm. long: corolla constricted at the base, gaping though not so widely as in other southwestern species, 2.5–3 cm. long, dull cream yellow with a large purple blotch in upper side of the throat and spreading over the two upper lobes, 5-lobed, the upper and lateral reflexed, entire to repand; tube glandular-pubescent over the entire outside and somewhat so within the throat: stamens didynamous, the rudiment of the fifth only 1 mm. long; filaments glabrous except at the base where they are finely glandular: ovary finely glandular; style longer than the stamens; pistil 2-parted: fruit as in the nearly related species, 1 dm. long, including the strongly incurved beak, very glandular-viscid without, endocarp tough, woody; seeds irregularly flattened by crowding, 6–8 mm. long, black.

Collected at San Augustine Ranch at the base of the Organ Mountains, Doña Ana Co., August 30th; altitude 4500 feet, no. 580. I also collected it at Las Cruces, August 23, 1895. Thurber's no. 913 from Sonora, Mexico, September, 1851, and same number from Corralitas, Chihuahua, Mexico, August, 1852, should be referred here, as well as Dr. Mearns' no. 215 from Fort Verde, Arizona, September 14, 1887, and Wright's no. 429 (in Columbia Herbarium) without locality but probably from some place in Texas or Chihuahua near El Paso. This plant has been referred generally to *M. fragrans* Lindl. but it is easily separated from that species by its smaller, dull colored and less gaping corolla and narrower calyx-segments. I have confused it with *M. proboscidea* Glox. and it may be the plant Dr. Gray has in mind when extending the range of that species to New Mexico. Most herbarium material represent the plant but poorly, since it is only possible to press the tips of the branches with the smaller leaves or else collect only young plants which show only small leaves, thus causing it to be considered with the smaller forms. I have seen a single well-grown plant which covered three to four square meters of ground with the tips of its stems 3–6 dm. above the ground.

ARTEMISIA MICROCEPHALA.

Perennial herb about 6 dm. high with several erect paniculately branching stems, whole plant flocculently white-tomentose: upper leaves linear- to narrowly oblong-lanceolate, 1–3 cm. long, 2–5 mm. broad, tapering both ways, entire, acute though occasionally 3-toothed at the apex, lower leaves often 3–5-lobed, 4–5 cm. long and 6–9 mm. broad: heads in a bracted terminal panicle, numerous, smaller than any in the group to which the plants belong, 3 mm. high and 2 mm. in diameter, 15–20-flowered: flowers very small, yellow, about half in each head with much reduced tubular corolla and pistillate, the others hermaphrodite and with normal tube: akenes glabrous and without pappus, about 1 mm. long.

Collected in the Organ Mountains, Doña Ana Co., September 1, no. 504, at an altitude of about 4800 feet and distributed as *A. gnaphalodes* Nutt. Also collected at Albuquerque, N. Mex., in the fall of 1894 by President C. L. Herrick of the New Mexico State University. These plants agree exactly with the specimen of Wright's no. 1276 in the Columbia Herbarium referred to by Dr. Gray as "a small leaved and very canescent form like Wright's no. 391"* but without giving locality of collection. It is probably from the mountains of southern New Mexico.

This plant is most nearly related to *A. gnaphalodes* Nutt. from which it may easily be separated by its more slender habit and its much smaller leaves and heads of flowers.

The following described plants, all but two of which are from New Mexico, may properly be published along with those preceding although not collected on the trip referred to above. The two Arizona plants will probably be found in New Mexico when all her plants are known.

SOPHIA OCHROLEUCA.

Erect branching annual herb 5–7 dm. high, the whole plant except the flowers and fruit finely tomentulose with soft branching hairs giving it a greenish-gray color: leaves alternate, 5–13 cm. long, 1.5–3 cm. broad, oblong in outline, tri-quadripinnate, ulti-

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* Pl. Wright. **2**: 98.

mate segments small, 2–4 mm. long and half as broad, oblong-elliptic, obtuse: flowers in terminal racemes: sepals oblong, obtuse, purplish tinged without, glabrous, 1.5–2 mm. long: petals elliptic, short-clawed, 2.5–3 mm. long, cream white, sometimes a little purplish tinged: stamens tetradynamous, the longer of the length of the petals: ovary in flowers just opening oblong-cylindric as long as the stamens: stigma sessile: silique terete, 8–10 mm. long, tapering at base, obtuse, glabrous, valves strongly 1-nerved, replum very thin; seeds in two rows in each cell, elliptical, yellow; pedicels slightly shorter than the pod, ascending, the pod and pedicel in the same straight line making an angle of about 35 degrees with the rachis.

Collected at Mesilla Park, New Mexico, in April, 1897, by Prof. J. D. Tinsley.

This plant has no doubt been confused with various other western plants which have gone as *Sisymbrium canescens* Nutt., though I find no material of the species in the herbarium of Columbia University. It is easily separated from all other related species by the color of the flowers alone. From *S. pinnata* (Walt.) Britton it may be separated by its short ascending pedicels and pods and larger and more dissected leaves; from *S. Hartwegiana* (Fourn.) Greene by its much more dissected leaves with elliptical segments and its stouter more obtuse pods.

PROSOPIS VELUTINA.

Spiny shrub (?) generally somewhat resembling *P. glandulosa* Torr.: stems terete, brownish, young parts velutinous; stipular spines stout, not very numerous, 1–2 cm. long: leaves fascicled; petiole 1–5 cm. long; pinnae 1–2 pairs, about half the leaves having two pairs; leaflets 12–19 pairs, elliptic-oblong, 7–10 mm. long, 2–4 mm. broad, obtuse, crowded, coriaceous, strongly veined, the whole leaf being finely velutinous even in age; stipules small, subulate, yellow: flowers greenish-yellow, in cylindrical spikes 5–10 cm. long: calyx campanulate with 5 very short teeth, ciliate: petals 5, oblong, obtuse, very strongly ciliate within: stamens 10, distinct, exserted: pistil simple: fruit a stipitate pod, linear, 10–15 cm. long, flattened and compressed between the seeds, straight or falcate, very velutinous when young and pubescent even in age, indehiscent.

Probably first collected with young fruit in the valley of Nazas in northern (?) Mexico by Gregg, May 10, 1847, and labeled "Bolsonde Mapimi."

Collected also by Schott "between the Colorado and Santa Cruz River, Sonora," some time in the early fifties. Pringle's plants collected in Arizona on mesas and in valleys in flower, Apr. 23, 1881, and in fruit, August 3, 1884, belong here as well as the specimen collected by Dr. Wilcox at Fort Huachuca, Ariz., May, 1892.

The plant is of course closely related to *Prosopis glandulosa* Torr. but is easily distinguished from that species by its velvety pubescence on the leaves, fruit and all young parts and by the leaves with frequently two pairs of pinnae and small crowded leaflets.

PARRYELLA ROTUNDATA.

Low shrub, 6 dm. high or more, branching at the ground and spreading, young parts canescent, with appressed rather coarse white hairs, numerous sessile brown glands on all parts: leaves alternate, narrow, 10–12 cm. long, 7–10 mm. wide; leaflets about 25 pairs, broadly elliptical to rotund, obtuse or retuse, 1–6 mm. in longest diameter, the largest leaflets near the middle of the rachis, those at the tip exceedingly small; proper petiole short, only 3–5 mm. long; stipules about as long, narrowly lanceolate, deciduous: flowers inconspicuous in short terminal almost sessile crowded spikes, 1–2 cm. long, generally rather closely resembling the flowers of the other known species: bracts linear, two-thirds as long as calyx; calyx-tube angular, turbinate, very canescent and glandular, 2–3 mm. long; limb 5-parted, segments triangular, acute, densely hirsutulose within: corolla wanting: stamens 10, free, exserted, of unequal length; anthers similar: ovary elliptical, two-ovuled, and with the 4–5 mm. long style sparingly hirsute: fruit unknown.

Collected at a point about five miles north of Winslow, Ariz., June 29, 1892, in reddish soil.

It is easily separated from the only other known species of the genus by its rounded leaflets and its very glandular calyx. The exact size of the shrub will probably need correction, since I only saw one poorly developed individual.

PHACELIA INTERMEDIA.

Erect, branching, viscid, glandular and slightly hispidulous annual, 1–3 dm. high (generally about 1.5 to 2 dm.): stems terete, reddish tinged, quite glandular with a fine puberulence next the stem and with scattering to thickly set hispidulous white hairs over the surface, the latter thicker on the inflorescence: leaves oblong-lanceolate in outline, 3–14 cm. long and .5–2 cm. broad, obtuse, crenately lobed and lobes coarsely crenate-toothed, short-petioled: flowers in terminal compound coiled helicoid cyme which uncoils as the fruit is produced; main peduncle 2–8 cm. long; pedicels 1 mm. long: sepals 5, spatulate, obtuse, 3 mm. long, very glandular and hispidulous: corolla funnelform, 5–6 mm. long, bright violet, lobes obovate-elliptical, subentire, spreading appendages at base of stamens attached for full length on side away from filament and for lower half their length on the other side to the base of filament and to each other, tips free, not enclosing the base of filament: stamens and pistil half as long again as corolla and exserted; style divided two thirds of its length, its base and the top of the ovary hispidulous: pod globose, slightly longer than the persistent sepals: seeds 4, elliptical, 2–3 mm. long, brown, not winged but strongly concave with a prominent ridge running lengthwise of the concave side, transversely rugose on concave side, finely pitted all over.

Collected on the mesa near Las Cruces, Doña Ana Co., N. Mex., April 10, 1893. President C. L. Herrick, of the University of New Mexico, collected the same species in the Florida Mts. near Deming, New Mexico, March 14, 1897, and in the Tres Hermanas Mts., March 20, the same year.

Dr. Rusby's plant from some place in New Mexico (label misplaced), some plants collected by Capt. E. K. Smith in Sonora (reported in the Bot. Mex. Bound. Surv. under *P. ciliata*), Wright's no. 1579 as represented in Columbia University herbarium, and Thurber's no. 11, in the same herbarium, from El Paso, March, 1851, should all be referred here. The species has been confused with *P. integrifolia* and *P. crenulata*, Dr. Gray modifying the original description of the latter species sufficiently to include it. Our plant is most like *P. crenulata* but is to be distinguished by its more numerous glands and noticeably less hispidulous character; its leaves have rounded lobes, not incised, its flowers are smaller with more nearly entire corolla-lobes and the seed is strongly transversely rugose.

ASTER (CONYZOPSIS) WOODHOUSEI.

Low spreading annual, 1 dm. high or less; stems terete, sparingly pubescent: leaves linear-oblanceolate, 1–2 cm. long, 1–3 mm. broad, sessile and somewhat clasping, obtuse, with minute hispidulous teeth along the margin, apex tipped with a short stiff hair: heads numerous, terminating short branches, 7–10 mm. high; involucral bracts fleshy, imbricated in about three rows, oblanceolate, 3–7 mm. long, 1 mm. or less broad, acute, the inner tinged purple at the tips; receptacle naked, alveolate: flowers numerous, rays fertile, in two or three rows, narrowly linear, inconspicuous, only exceeding the pappus by about 1 mm., purple (?); disk flowers narrowly tubular, expanded slightly at the top into a campanulate throat, the whole corolla shorter than and included in the sordid to tawny pappus: akenes 1–2 mm. long, slightly angled, narrowly turbinate, appressed-pubescent; pappus of numerous capillary, minutely scabrous bristles, about 6 mm. long.

First collected near the Pueblo Indian village of Zuni, in western New Mexico, by Dr. S. W. Woodhouse, in September, 1851. Again collected "in wet springs, eastern New Mexico,"* by Dr. Bigelow, in September, 1853. In the reports of both the above collections, Dr. Torrey referred the plant to *Aster angustatus* (Nutt.) T. & G. I have recently received specimens of the same plant collected by President C. L. Herrick, of the University of New Mexico, in the fall of 1894 at Albuquerque, New Mexico.

Our plant is most nearly related to *Aster frondosus* (Nutt.) T. & G., and is included in that by Dr. Gray in the Synoptical Flora. It is easily separated from that species by its decumbent habit, smaller size, smaller and less crowded heads and smaller, more pubescent leaves.

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*Pacif. R. R. Rept. 4: 97. 1856.

A New Southwestern Sophia.

BY T. D. A. COCKERELL.

SOPHIA HALICTORUM.

Annual; branching from the base, spreading, bushy, but not decumbent; about 40 cm. high, or often taller, whitish-green, with pubescence consisting of very short branched hairs, replaced on the green peduncles mainly by hyaline knobbed glandular hairs, so that the upper parts of the plant are not canescent: stems purple at base: leaves pinnatifid, with linear divisions: the lower leaves bipinnatifid, the divisions all linear and rather long: flowers minute, yellow: stamens considerably exceeding the petals: calyx with sparse white hairs: mature pods pinkish, 11 mm. long, their pedicels 5 or 6 mm.; seeds in two very distinct rows, bright orange, covered with minute tubercles arranged in longitudinal series: pedicels divergent or slightly ascending, and the pods 4-carinate, entirely glabrous.

Mesilla Park, New Mexico, in the zone of mesquite and *Atriplex canescens*, flowering in March and April and very abundant. It is freely visited by bees of the genus *Halictus*, whence the specific name. It occurs in dry places, also in the bottom land, but in irrigated fields it is replaced by *S. ochroleuca* Wooton, which is paler, more spreading, with yellowish-white flowers, more dissected leaves with much shorter segments, and no knobbed gland-hairs on the peduncles. In my bee-papers, I have referred to *S. halictorum* as *Sisymbrium canescens*, but it differs widely from that plant (which I was familiar with in Colorado) in its general appearance, leaves, flowers and fruit. (Compare the figures in Britton and Brown, Ill. Fl. **2**: 145.) In some respects it more resembles *S. Hartwegiana*, but the segments of the leaves are longer and the pedicels are conspicuously divergent. The flower is most like that of *S. Hartwegiana*, but the seeds are always conspicuously in two rows.

MESILLA PARK, N. M.,
May 7, 1898.

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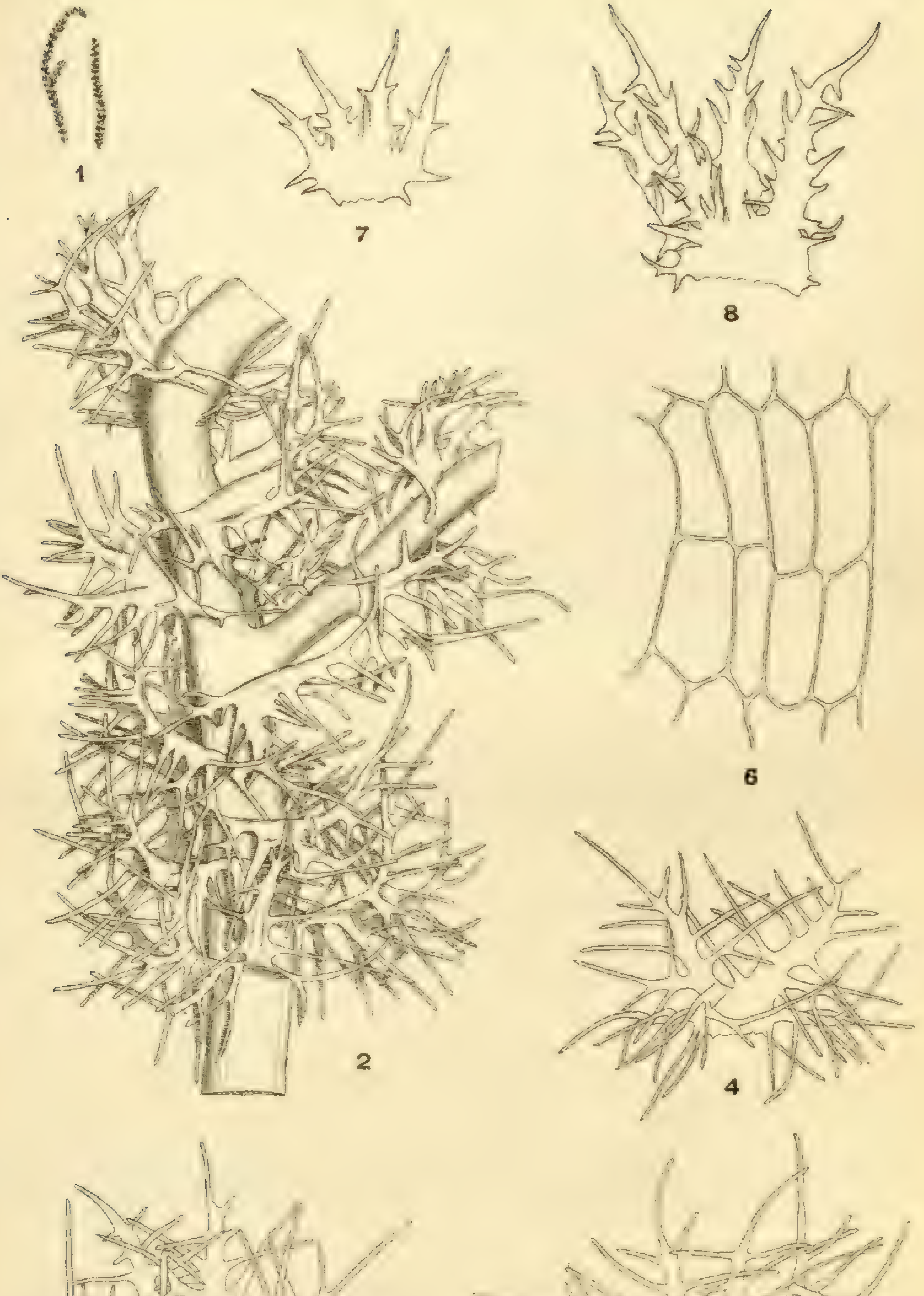

A. W. E. del.

1-6. BLEPHAROSTOMA PILOSUM Evans.
7, 8. BLEPHAROSTOMA QUADRIPARTITUM (Hook.) Trevis.

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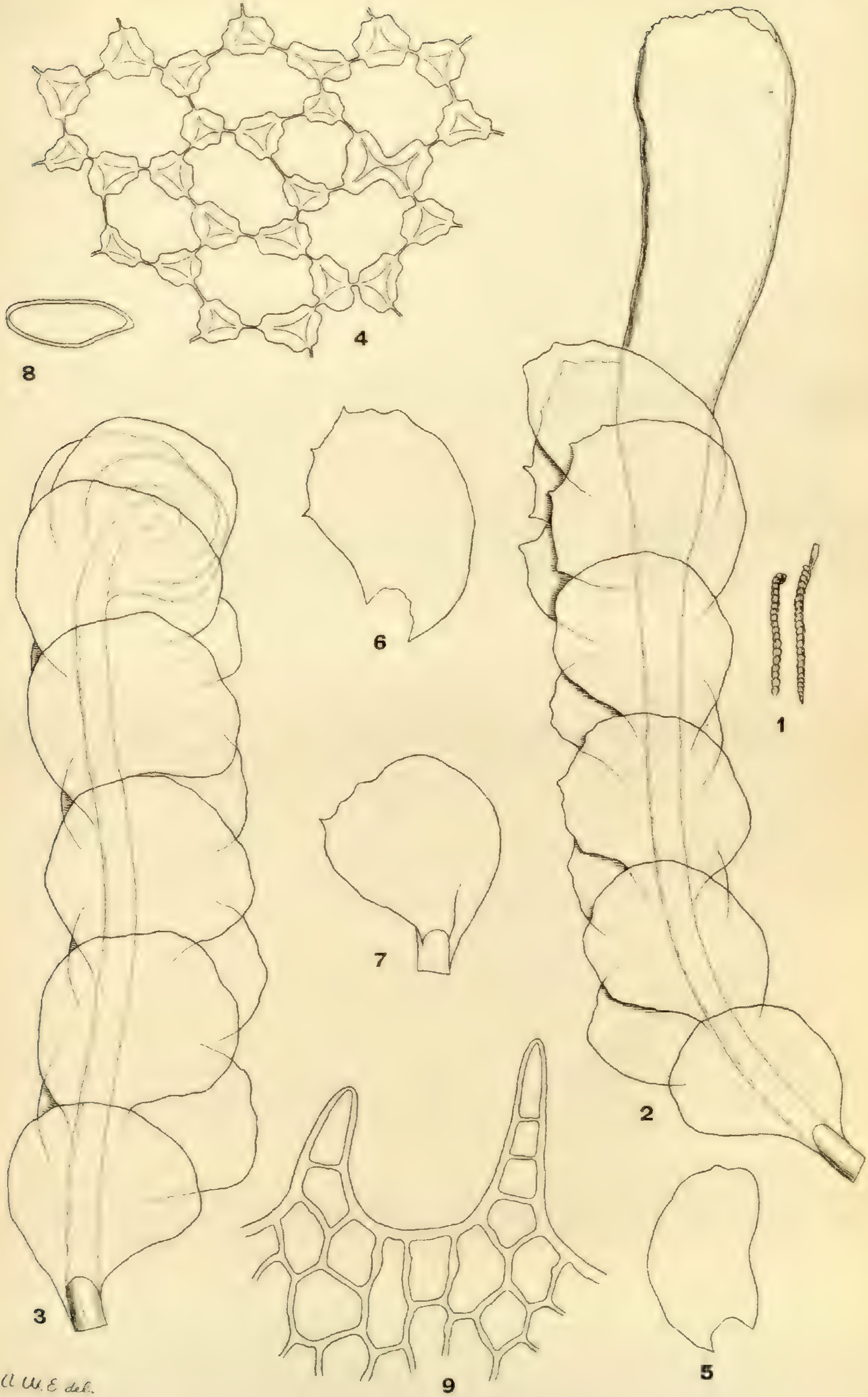
1-7. JUNGERMANNIA HATCHERI Evans.
8-18. JUNGERMANNIA PROPAGULIFERA Gottsche.



A. W. E. del.

PLAGIOCHILA ANSATA Hook. f. and Tayl.

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Wooton, E. O. New Plants from New Mexico.—II. Bull. Torr. Bot. Club, **25**: 304–310. 8 Je. 1898.

New species in *Selinocarpus*, *Berberis*, *Sphaeralcea*, *Gaura*, *Scrophularia*, *Sambucus*, and *Sicyos*, and *Fallugia paradoxa acuminata* var. nov.

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VOL. 25 No. 9

BULLETIN
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TORREY BOTANICAL CLUB

SEPTEMBER 1898

Studies in the Botany of the Southeastern United States.—XIV.

BY JOHN K. SMALL.

I. HITHERTO UNDESCRIBED SPECIES.

NYMPHAEA MACROPHYLLA.

Perennial from very thick horizontal rootstocks, bright green. Foliage glabrous or nearly so: leaves (emersed) leathery; petioles short, sometimes sparingly pubescent; blades oblong-ovate, 3–8 dm. long, obtuse, notched at the apex, 1–2.5 dm. broad at the middle; sinus V-shaped, or rarely closed: flowers erect, subglobose, 3–5 cm. in diameter: sepals leathery, 2.5–3 cm. long, concave: petals yellow, slightly longer than the sepals: stamens numerous: stigmatic disk becoming 3–3.5 cm. broad, often deeply crenate, the coarse stigmatic lines not approaching the edge: capsule ovoid, 3–4 cm. high, coarsely ribbed above the middle: seeds subglobose, 5–6 mm. in diameter.

In ponds, creeks and slow streams, Florida to Louisiana. Spring to fall.

Both old and recent specimens of the common species of *Nymphaea* of Florida and the other Gulf States indicate that it is specifically distinct from the northern *Nymphaea advena*. Plants belonging to this segregate may be recognized by the very large leaf-blades which are of a peculiar ovate-oblong shape and with a midrib that dries flat. In the flower the larger stigmatic disk is often much more deeply crenate than in the case of *Nymphaea advena* and its stigmatic lines, although larger, terminate remotely from the edge of the disk.

I have seen specimens from several of the Gulf States:

Florida: In tidal creeks, Duval Co., May; *A. H. Curtiss*, no. 102. Eustis Lake Co., Aug. 16–25, 1894, *G. V. Nash*, no. 1751. Miami river, March 7, 1892, *J. H. Simpson.* Apalachicola, *Chapman.*

Louisiana: Hale.

AQUILEGIA AUSTRALIS.

Perennial, bright green. Stem erect, usually solitary, 3–9 dm. tall, branching above, finely pubescent or glabrate in parts: leaves with slender petioles, except on upper part of the stem; blades twice ternate; leaflets thin, reniform, suborbicular or orbicular-obovate, 1–2 cm. long, glaucescent, especially beneath, crenately toothed or lobed, rounded or subcordate at the base: corolla mainly scarlet: sepals erect, lanceolate or oblong-lanceolate, somewhat acuminate, 1.5 cm. long, scarlet: spurs 3–3.5 cm. long, rather abruptly narrowed below the middle: styles more than twice as long as the ovary: follicles about 1.5 cm. long, about as long as the bristle-like style.

On limestone cliffs and bluffs, Florida to Texas. Spring.

Several specimens of this hitherto undescribed species have been lying in the herbarium of Columbia University for many years. The species apparently belongs to that class of plants which is peculiar to the Gulf States. It can be distinguished from *Aquilegia Canadensis* at a glance by its more slender habit, pale green or glaucescent foliage and especially by the narrow elongated sepals. The spur is more abruptly narrowed below the middle than it is in *Aquilegia Canadensis.*

The following specimens are referred here:

Florida: Lime cliffs, Marianna, *Chapman.*

Texas: Blanco Bottoms, April, 1856; Valley of the Blanco, *Wright.*

HEUCHERA MACRORHIZA.

Perennial, bright green. Rootstocks stout, woody, 1–3 dm. long, scaly: leaves basal; petioles 1–3 dm. tall, densely villous; blades suborbicular in outline, 8–20 cm. in diameter, shallowly 5–9-lobed (lobes much broader than long), sharply, closely and irregularly dentate with apiculate teeth, pubescent on both sides, sparingly so above, densely ciliate, cordate: scapes erect or nearly so, 2–5 dm. tall, naked or with several scales, surpassing the leaves: panicles 5–12 cm. long, nearly cylindric: calices densely pubescent, 2 mm. long or 2.5 mm. long at maturity; tube campanulate; segments oblong or ovate-oblong, about as long as the tube, erect: petals linear from a filiform base, fully twice as long as the calyx-segments: capsules about equaling the calyx at maturity, tipped by the slender styles.

On river bluffs near Nashville, Tennessee. Summer. This relative of *Heuchera villosa* is apparently about as restricted in its distribution as that species is widely dispersed. The two species are quite similar in habit, but differential characters are plentiful from the rootstock to inflorescence. The woody rootstock varying from 1.5–2 cm. thick is unknown in *Heuchera villosa.* The pubescence wherever present is of a different type, the individual trichomes being shorter and stouter. A conspicuous character is the shallowly many-lobed leaf-blades with their closely dentate margins. A peculiar and apparently constant difference exists in the inflorescence: in the case of the species just described the pedicels are more densely pubescence than the calices, while in the case of *Heuchera villosa* the calyx is the more densely pubescent member.

The original specimens were collected by Dr. Gattinger along the Cumberland River at Nashville, Tennessee, August, 1878. These specimens are in the Gattinger Herbarium at the University of Tennessee. I am indebted to Prof. S. M. Bain for the use of this material.

✓EUPHORBIA APOCYNIFOLIA.

Perennial, bright green. Stems solitary or tufted, erect or ascending, 2–6 dm. tall, slender, sparsely pubescent or glabrate, zigzag, at least at maturity, topped by a 2–3-rayed umbel: rays dichotomous, wire-like or filiform, ascending: leaves alternate except the whorl or pair subtending the umbel; blades thinnish, oblong to oval, 2–7 cm. long, obtuse, slightly revolute, pale beneath, with glaucous midrib; petioles 3–6 mm. long, densely villous: bracts opposite, similar to the leaves but smaller: peduncles filiform, glabrous: involucres campanulate, barely 1.5 mm. high, glabrous: glands transversely oblong, about 0.5 mm. broad: appendages white, orbicular-cuneate, 1.5–2 mm. long, rounded at the apex.

In sandy soil, Florida. Fall.

Euphorbia apocynifolia is related to *Euphorbia corollata* but differs in the more slender habit, the broader and thinner leaf-blades and the densely villous petioles. The petal-like appendages are smaller than those of *Euphorbia corollata* and are rounded at the apex. The habit of the newly described species suggests that of *Euphorbia paniculata.*

The original specimens of *Euphorbia apocynifolia* were collected by Mr. Geo. V. Nash at Quincy, Gadsden County, Florida, on September 4, 1895, number 2567.

SIDA LEPTOPHYLLA.

Perennial (?), thinly pubescent. Stems erect, over 10 dm. tall (in specimens seen), widely branching: leaves numerous, blades thin, linear to linear-oblong, 2–10 cm. long, acute, sharply serrate with short flaring teeth above a short entire base, paler beneath than above, obtuse or rounded at the base; petioles 3–10 mm. long; stipules subulate, filiform: pedicels 2–8 mm. long: calices finely pubescent; segments 4–5 mm. long, triangular, acute, or somewhat acuminate, about as long as the tube: corollas about 2.5 cm. broad: fruit 6–7 mm. broad; carpels 2-ridged above, not pointed, glabrous.

In sandy soil, Georgia.

This species gives us an eastern relative of *Sida Lindheimeri.* It is related to *Sida Neo-Mexicana* by its inflorescence, mainly by the short peduncles, but in other parts and in habit it is more like *Sida Lindheimeri.* From the latter species it differs by the short-peduncled, often clustered flowers, the thinner leaf-blades with their finer and sharper teeth and the glabrous pointless carpels. The specimens on which the species is founded were collected in Georgia by Dr. Boykin and his label contains this record, "This is the large flowering *Sida*, of which there are seeds in the other box. If not *S. gracilis*, is new. I have thought it not described by Mr. E.[lliott] and if so incorrectly."

RHEXIA FILIFORMIS.

Perennial, slender, sparingly pubescent. Stems erect, wire-like, 1–4 dm. tall, villous-hirsute, simple or branched, terete or nearly so; branches filiform: leaves quite numerous; blades linear-filiform or filiform, 1–3 cm. long, acute, serrulate, sessile, the larger ones involutely folded: flowers in open cymes, short-pedicelled: calyx glabrous; segments lanceolate, acuminate: corollas white or pale purple; petals less than 1 cm. long: anthers linear, 6 mm. long, spurred at the base: capsules subglobose.

In sandy soil, Georgia and Florida. Summer.

While collecting along the southern border of Georgia I met this delicate little species of *Rhexia* at various places. It is related to *Rhexia lanceolata* but is smaller and all its parts are much more slender. The linear-filiform or filiform leaves, the small corollas and the glabrous calices are all diagnostic characters readily separating *Rhexia filiformis* from *Rhexia lanceolata*.

CONRADINA PUBERULA.

A much branched shrub, 3–7 dm. tall: foliage cinereous-puberulent: leaves numerous, often clustered in axils; blades narrowly linear, 1–2.5 cm. long, obtuse, entire, strongly revolute, sessile: clusters 2–6-flowered, often forming a continuous raceme; pedicels commonly 1–2 mm. long: calices 5–6 mm. long, puberulent, tubes slightly ribbed; upper lip with 3 ovate or ovate-lanceolate acute ascending teeth; lower lip with 2 lanceolate-subulate teeth: corollas 12–15 mm. long; tube as long as the calices or nearly so; upper lip retuse; lower lip 3-lobed, lateral lobes rounded, middle lobe cuneate-flabellate, deeply notched: nutlets 1 mm. long, globose-oval, smooth and glabrous.

In sand, Florida. Spring and summer.

Conradina is not a monotypic genus, for it is perfectly clear that two distinct species have been associated under the name *Conradina canescens*. Both species are peculiar to Florida, and the one heretofore undescribed is apparently the more widely distributed. *Conradina puberula* may be distinguished from *Conradina canescens* at a glance by the larger size of all its parts and the puberulence of its foliage, hirsute pubescence being usually absent and being found, if present, only about the mouth of the calyx. The calyx is longer than that of *Conradina canescens*. Prominent characters exist in the corolla, in which the upper lip is retuse and the middle lobe of the lower lip is cuneate-flabellate and deeply notched. In *Conradina canescens* the upper lip is rounded, and the rounded middle lobe of the lower lip is not prominently produced beyond the lateral lobes. The newly described species is represented in the herbarium of Columbia University as follows:

Florida: Apalachicola, old specimen, collector uncertain; later specimen, *A. H. Curtiss*, no. 2014. Also two specimens collected by Dr. Chapman.

The habit of *Conradina puberula* suggests that of *Hypericum galioides.*

KOELLIA BEADLEI.

Perennial, deep green. Stem erect or ascending, 5–8 dm. tall, simple or sparingly branched, minutely pubescent: leaves opposite, lower glabrate but resinous-dotted, the floral slightly canescent; blades oblong-lanceolate, or those of the branches elliptic-lanceolate to ovate, all acute or acuminate, 3–8 cm. long, serrate, rounded or subcordate at the base; petioles 1–3 mm. long: clusters solitary or few, terminal, dense, 1–2 cm. broad: bracts narrowly linear or slightly broadened at the middle: calices puberulent, 4–5 mm. long, tube finely ribbed; teeth triangular-lanceolate, with subulate tips barely one third as long as the tube: corollas 6–7 mm. long; tube not surpassing the calyx; upper lip oblong, obtuse; lower lip 3-lobed, middle lobe oblong, notched, lateral lobes rounded: filaments and style glabrous.

On rocks, mountains near Highlands, North Carolina. Summer and fall.

The center of distribution of the *Koelliae* furnishes us with still another species. The plant in question is related to *Koellia pycnanthemoides*, but the leaves and stem are destitute of the peculiar pubescence characteristic of such plants as *Koellia pycnanthemoides, K. albescens* and *K. incana.* The leaves suggest those of certain species of the genus *Monarda.* They are conspicuous on account of a very fine sprinkling of sparkling glands and the prominent whitish nerves beneath. The calyx-segments are subulate from a triangular lanceolate base and barely one third as long as the tube.

The original specimens were collected on mountain rocks, Highlands, Macon County, North Carolina, September 14, 1897. They were distributed by the Biltmore Herbarium, for whose curator the species is named. It is numbered 5744.

PENTSTEMON CALYCOSUS.

Perennial, minutely pubescent or glabrate. Stem erect, 4–7 dm. tall, simple below: leaves various; basal and lower stem-leaves spatulate, upper stem-leaves opposite; blades oblong to lanceolate, acute or acuminate, sharply serrate, closely sessile and partly clasping: panicles rather loosely flowered: calices sparingly glandlar-pilose, segments about 1 cm. long, with a narrowly lanceolate base and narrowly linear tip: corolla purple, about 2.5 cm. long; tube abruptly dilated about the middle; segments ovate or broadly oblong-ovate, those of the upper lip much smaller than those of the lower: sterile filaments sparingly bearded above the middle: capsules ovoid, 5–6 mm. high.

On bluffs, Tennessee and Louisiana. Spring.

In a former number of this journal* I published a note on the occurrence of *Pentstemon Smallii* at Nashville, Tennessee. A further study of the section of *Pentstemon* to which the species in question belongs convinces me that the Nashville plants are specifically distinct from any described form. The elongated calyx-segments are diagnostic. An old specimen with mature fruit but no flowers preserved in the herbarium of Columbia University seems to belong in *Pentstemon calycosus.* Its label bears this record, "Fertile soils, Louisiana, Hale; April."

✓ PENTSTEMON HELLERI.

Perennial, mostly puberulent, or glabrate, below the inflorescence, thence minutely glandular-pubescent. Stems erect or ascending, 3–6 dm. tall, simple up to the inflorescence: leaves opposite, glabrous or nearly so, lustrous; blades various, those of the basal and lower stem leaves oblong-spatulate or nearly linear, 6–10 cm. long, acute, narrowed into winged petioles, blades of upper leaves oblong to broadly ovate, acute, sessile; all undulats or slightly toothed: calices densely glandular-pubescent; segements ovate to elliptic-ovate, 8–10 mm. long, acutish: corollas white or rose, sometimes tinged with blue, minutely glandular-pubescent, 3–3.5 cm. long, rather gradually enlarged, upper lip with shallowly notched lobes, lower lip with truncate or retuse lobes: capsules conic-ovoid, at least 1 cm. long, not reticulated, much surpassing the calyx.

On prairies, Kerrville, Texas. Spring.

Mr. Heller informs me that he very reluctantly associated the name *Pentstemon Cobaea* with his number 1610 in his distribution of "Plants of Southern Texas." These specimens form the type of a species perfectly distinct from *Pentstemon Cobaea.* Plants belonging here may be found under the name *Pentstemon Cobaea* in various herbaria, but they may be separated by the much smaller and differently shaped corollas and the smaller capsules which conspicuously surpass the calyx. The original specimens are from Kerrville, Kerr County, Texas, collected in April and June, 1894.

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* Bull. Torr. Bot. Club, **21**: 304. 1894.

✓ LACINARIA FLABELLATA.

Perennial from globose or spheroidal corms, showy. Stems erect, 3–6 dm. tall, simple, lanuginose, angled, usually solitary: leaves rather numerous; blades linear or nearly so, lower ones 5–10 cm. long, acute or acutish, spreading, narrowed into margined petioles, upper much reduced, sessile, more or less strongly reflexed, all densely punctate, glabrous: racemes conspicuous, 1–2 dm. long, 3 cm. thick: heads narrow, ascending, 1–1.5 cm. long: bracts linear-lanceolate to linear, outer somewhat keeled, with spreading entire or denticulate acuminations, inner with pale magenta fan-shaped erose-dentate tips: pappus bristles somewhat plumose, rather few: achenes densely pubescent.

In dry open woods, St. Helena Island, South Carolina. Fall.

One of the neglected and yet extremely interesting portions of the Southern States is the territory formed by the numerous islands along the Atlantic coast. Collections from some of these islands have lately been put at my disposal by Mr. A. Cuthbert, and the indications are that a complete series of specimens representing the flora of the region in question would reveal many curious and hitherto unknown species. One of the more interesting plants from these islands is the above described *Lacinaria*, which makes a second species for the group in which *Lacinaria elegans* has previously stood alone. *Lacinariæ flabellata* is of smaller stature than *L. elegans*. Chief among other differences between the two species is the character of the inner bracts of the involucres. The dilated, toothed, rounded or truncate tips of the bracts have nothing parallel in *L. elegans*. The original specimens were collected by Mr. A. Cuthbert on St. Helena Island, South Carolina, September, 1894.

✓ LACINARIA LAXA.

Perennial, thinly tomentulose, or leaves glabrate. Stems erect, 4–6 dm. tall, stoutish, racemose above: leaves rather numerous; blades linear, sometimes rather broadly so, 1–2 dm. long, lower ones narrowed into short winged petioles, upper sessile, much reduced : peduncles villous, longer than the heads or shorter : heads loosely disposed, involucres short, about 5 mm. high, campanulate : bracts oblong or oblong-lanceolate, obtuse or acutish, keeled, conspicuously ciliate, lax at maturity, outer purple, inner purple-tipped : pappus barely barbellulate : achenes 3–3.5 mm. long, finely but rather densely pubescent.

In sand, Cape Florida, Florida. Spring.

The above is most closely related to *Lacinaria graminifolia pilosa*, but the characteristic ciliation of the petioles is lacking and the involucres are campanulate and shorter. The bracts of the involucres are shorter and narrower at the apex and very characteristic on account of the copious and conspicuous cilia.

The original specimens were collected by Mr. J. H. Simpson at Cape Florida, Florida, on March 14, 1892.

✓ Lacinaria Regimontis.

Perennial from small subglobose rootstocks, nearly glabrous. Stems erect, 3–9 dm. tall, usually paniculately branched, sometimes spicately racemose : leaves rather few, 1–2 dm. long or longer, reduced above ; blades narrowly linear, narrowed into winged sparingly ciliate petioles below, sessile above, all erect or ascending : involucres numerous, cylindric, becoming obconic, 8–10 mm. high, conspicuous on account of the slightly spreading bracts, erect or ascending, short-peduncled or some nearly sessile : bracts oblong-ovate to linear-oblong, acute to mucronate or the inner slightly hooded, the outer sometimes obtuse, all glandular-punctate, ciliolate, mostly with ring-like margins : pappus barbellulate : achenes 3.5–4 mm. long, ribbed, sparingly pubescent.

On wooded slopes, King's Mountain, North Carolina. Summer and fall.

The species just described suggests *Lacinaria graminifolia pilosa* in habit, but it has a very characteristic involucre ; this member becomes obconic and quite elongated at maturity, while the bracts, excepting some at the base of the involucres, are acute or mucronate, densely punctate and conspicuously wing-margined.

The original specimens were collected by the writer on the slopes of King's Mountain, North Carolina, on August 27 and 30, 1894.

✓ Lacinaria microcephala.

Perennial from ovoid or subglobose corms. Stems erect or ascending, rather slender, 3–7 dm. tall, solitary or tufted, striate-ridged, strict, rather slender, simple at least below the inflorescence: leaves numerous; blades linear, very narrowly so except those of lower leaves, 5–10 cm. long or shorter above, erect or strongly ascending, sparingly punctate, lower ones narrowed into sparingly ciliate petioles: heads numerous, slender, short-peduncled or the peduncles sometimes elongated and minutely bracted: involucres cylindric, 5–7 mm. high: bracts glabrous or nearly so, erect, appressed, obtuse, outer ovate, inner oblong, much longer than the outer, pappus-bristles coarsely barbellulate: achenes cuneate, about 2.5 mm. long, densely pubescent.

In sandy soil, Cumberland Mountains, Tennessee. Summer.

The segregate just described has heretofore been associated with *Lacinaria graminifolia*. However, its foliage is glabrous except for an occasional cilium on the petioles of the lower leaves or the edge of the involucral bracts. The cylindric heads are only about one-half as large as those of *Lacinaria graminifolia* and contain few flowers.

The original specimens were collected by Dr. Gattinger at Tullahoma, on the Cumberland Mountains, Tennessee, in August, 1867; September, 1877; August, 1878, and the fourteenth day of the same month, 1886. I am indebted to Prof. S. M. Bain, of the University of Tennessee, for the loan of the above cited specimens from the University Herbarium.

SOLIDAGO DELICATULA.

Perennial, smooth and glabrous, deep green. Stems erect, 5–10 dm. tall, ridged, sparingly or widely branched above, strict: leaves numerous; blades thinnish, somewhat parchment-like at maturity, linear-elliptic to linear-lanceolate or nearly linear, 2–8 cm. long, acuminate, sharply serrate, beyond the gradually narrowed base, sessile or with short winged petioles: panicle narrow or, when well developed, with widely spreading and recurved branches: heads numerous, 3.5–5 mm. high, short-peduncled, contiguous: involucres narrow: bracts narrowly lanceolate to narrowly linear, acute, very variable in length: flowers 3–6: rays yellow, often 2–3, linear-oblong, 1.5–2.5 mm. long: achenes minutely pubescent.

On prairies, northern Texas.

The specimens here described form a very characteristic species. This is related to *Solidago rupestris* but differs in its usually more lax habit and the absence of pubescence except the cilia of the leaves. With this exception the plants are smooth and glabrous throughout. The foliage is of a much deeper green than that of *Solidago rupestris* and the upper surface of the leaves is lustrous. The heads are twice as high as those of *Solidago rupestris* and suggest those of *Solidago odora.* The original specimens were collected by Mr. James S. Merriam, near Paris, in northern Texas, in 1872.

✓ Solidago Nashii.

Perennial, deep green. Stems erect, 6–10 dm. tall, simple below the rather ample panicle, more or less pubescent, especially above the middle, striate, nearly straight: leaves numerous; blades linear or narrowly linear, 4–10 cm. long, attenuate at both ends, finely but rather remotely serrate or nearly entire, sessile: heads numerous, 5–6 mm. high, short-peduncled, contiguous: involucres campanulate at maturity, erect: bracts linear-lanceolate to linear, acutish to obtuse, the outer pubescent: flowers 12–17, crowded: rays yellow, 3–4, linear: achenes 1–1.5 mm. long, minutely pubescent.

In hammocks, middle and peninsular Florida. Spring.

Plants belonging here have hitherto been referred to *Solidago Leavenworthii*, but their true relationship is rather with *Solidago rupestris* and its allies. Like *Solidago rupestris* the foliage below the inflorescence is glabrous or nearly so, but the heads are at least twice and often thrice as large and the bracts and flowers more numerous.

The original specimens are both from Florida. The first one was collected many years ago in Middle Florida by Dr. Chapman. The second was collected by Mr. Nash at Eustis, peninsular Florida in May, 1894, no. 691.

✓ Solidago dispersa.

Perennial, glabrous or nearly so. Stems erect, 8–10 dm. tall, ridged, loosely paniculate above: panicle narrow; branches slender or filiform: leaves rather few; blades narrowly elliptic to oblong-lanceolate, 2–10 cm. long, acute or acuminate, serrate, lower ones with winged petioles, upper sessile or nearly so: heads few, loosely disposed, 6–7 mm. high; terminal ones often drooping: involucres turbinate-campanulate at maturity: bracts narrowly oblong to linear, obtuse, with green tips: flowers 9–13: rays yellow, 2–3, oblong-linear, about 3 mm. long: achenes pubescent.

In the lower country, Louisiana.

Many distinct species are now associated together under the name of *Solidago Boottii*. The one just described belongs to this series and formed part of *S. Boottii* β of Torrey & Gray.[*] It is peculiar in being glabrous or nearly so above and with more or less pubescence on the lower leaves. The inflorescence is paniculate and very loosely disposed, while the branches of the panicle and the elongated peduncles are filiform or nearly so and quite weak. The teeth of the leaf-blades are more remote and appressed than those of *S. Boottii*.

The original specimens were collected by Dr. Leavenworth in Louisiana.

SOLIDAGO PLUMOSA.

Perennial, bright green, glabrous or nearly so below the inflorescence, inclined to be glutinous, especially above. Stems erect, often tufted, 4–10 dm. high, ridged, purple, strict: leaves alternate; blades spatulate to narrowly linear, 2–30 cm. long, obtuse, acute or acuminate, thickish, entire or remotely and shallowly toothed, narrowed into slightly margined petioles or the upper ones nearly sessile with smaller ones sometimes clustered in their axils: heads numerous, in narrow terminal panicles, 5–8 mm. long, often densely disposed: involucres campanulate at maturity: bracts linear, inner ones narrowly so, obtuse, erect: flowers 11–15, crowded; rays 3–5, yellow, 5–6 mm. long: achenes 3–3.5 mm. long, glabrous.

In cañons of Yadkin River, Stanley County, North Carolina. Summer and fall.

In a former issue of this journal[†] I called attention to the form just described as *Solidago plumosa*, hoping by that means to secure further data on its distribution. I am now convinced that the North Carolina plants are specifically distinct from *Solidago Purshii*, its more northern homologue. We have in the case of *Solidago Purshii* and *Solidago plumosa* two closely related but perfectly distinct species. The much larger size of the plants in the latter, the longer heads, and the perfectly glabrous achenes, serve to separate the two species.

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[*] Fl. N. A. **2**: 215.

[†] Bull. Torr. Bot. Club, **23**: 300. 1896.

SOLIDAGO CHRYSOPSIS.

Perennial, slender, glabrous. Stem erect or ascending, wire-like, 2–3 dm. tall, paniculate above, nearly naked: leaves mainly basal or near the base of the stem, 6–20 cm. long or those on stem shorter; blades elongated linear, acute, entire or nearly so, acute, curved, slender-petioled: heads in narrow panicles 4–5 mm. high, conspicuous on account of the silvery-white pappus: involucres becoming lax: bracts thin, linear-lanceolate or linear, rather obtuse: flowers 11–14: rays yellow, several, linear: achenes finely pubescent.

In sand, Pine Key, Florida.

The specimens which form the basis of the species described above as *Solidago Chrysopsis* were included in *Solidago gracillima* by Dr. Gray and were collected by Mr. Blodgett on Pine Key, Florida. Primarily the species differs from *Solidago gracillima* in its very slender habit and the inflorescence which suggests that of some species of the genus *Chrysopsis*, similar also in habit to that of *Solidago laxa*. The stems bear very few leaves. The thin narrow linear or linear-lanceolate bracts of the involucres form a strong contrast with the thick broad bracts of *Solidago gracillima*. The several rays are also diagnostic so far as *Solidago gracillima* is concerned.

SOLIDAGO FLACCIDIFOLIA.

Perennial, glabrous below the inflorescence, bright green. Stems erect or ascending, 7–11 dm. tall, simple or nearly so, ridged, slightly zigzag: leaves alternate; blades elliptic, 6–15 cm. long, thin, acuminate, sharply serrate above the cuneate base, sessile or nearly so: heads few in axillary clusters, short-peduncled, 4 mm. high, clusters subtended by spatulate or elliptic-spatulate bracts: involucres campanulate: bracts linear, finely pubescent, obtuse, green or green-tipped: flowers 5–7, crowded: rays yellow, oblong or ovate-oblong, 3 mm. long: achenes pubescent.

On hillsides, Rome, Georgia. Fall. Like so many others of the species of the Southern States, *Solidago flaccidifolia* will doubtless prove to be a local species. It is most closely related to *Solidago pubens* from which it differs in the almost glabrous foliage, only the upper part of the inflorescence is pubescent and hairs are sparse, short and not spreading. The leaf-blades are larger and their margins are not toothed so far below the middle. The involucres are shorter than those of *Solidago pubens* and the bracts less densely pubescent and broader.

The original specimens were found at Rome, Georgia, by Dr. Chapman, in September, 1872.

SILPHIUM VENOSUM.

Perennial, glabrous or nearly so. Stems erect, scape-like, 8–12 dm. tall, slender, corymbosely branched above, glaucous, channelled : leaves basal ; blades ovate to oblong, 1–3 dm. long, with deep red nerves, pinnately parted ; segments linear to linear-oblong, coarsely and irregularly toothed or incised, obtuse or acute ; petioles about half as long as the blades, dilated at the base : heads few, showy : involucres campanulate, about 1 cm. high : bracts broadly oblong to orbicular-oval and oblong, rounded at the apex, ciliolate : rays yellow, linear or nearly so, 1–1.5 cm. long : disk-corollas 6 mm. long ; segments broadly ovate, obtuse : achenes suborbicular, 1 cm. long ; wings produced into acute teeth and forming narrow U-shaped sinus.

In sand, southeastern Georgia. Spring and summer.

So far as we know the species here described for the first time is peculiar to the pine barrens about the Okefenokee swamp and the valley of the St. Mary's River in Georgia, where the writer collected specimens in June, 1895. The species is related to *Silphium compositum*, having much the same habit. Diagnostic characters exist in both the foliage and the inflorescence ; the petioles of the basal leaves are much shorter than the blades ; the latter members are longer and narrower than those of *S. compositum*, pinnately parted into several segments which are coarsely toothed or incised. The whole surface of the leaf-blades is delicately marked with deep red veins. The large suborbicular achenes with their broad wings and long teeth form a strong contrast with the achenes of *Silphium compositum*.

RUDBECKIA TRUNCATA.

Perennial, sparingly hirsute or glabrate. Stems erect, 3–8 dm. tall, solitary or tufted, simple or sparingly branched above : leaves various, the basal often in separate tufts ; blades narrowly elliptic, 5–10 cm. long, acute or acuminate at both ends, remotely and shallowly serrate, narrowed into winged petioles, these shorter than the blades ; stem leaves, except the lowest, alternate ; blades linear-oblong to linear, 3–10 cm. long, acute or acuminate, remotely serrate or nearly entire, sessile by a truncate base: heads showy: involucres somewhat foliaceous: bracts linear-lanceolate or nearly linear, about 1 cm. long: rays deep yellow, linear, 1–2 cm. long, usually 10–12: disk black, depressed: disk-corollas about 3 mm. long: disk-bracts linear-oblong, acute.

In meadows and dry soils, northwestern Georgia. Summer.

While working under the State Geologist of Georgia in the northwestern and little explored part of that State, I became acquainted with an undescribed species of *Rudbeckia*. The plant was quite common in the limestone districts. *Rudbeckia truncata* differs from *Rudbeckia fulgida* by more elongated basal leaves and the prominently 3-nerved leaf-blades throughout. The blades of the stem leaves, although rather narrow, have a conspicuous truncate base. The heads are larger than those of its relative and the bracts of the involucres more coarsely hirsute.

There is a specimen almost identical with mine in the herbarium of Columbia University [Chapman Herbarium], collected many years ago at Rome, Georgia.

HELIANTHUS VERTICILLATUS.

Perennial, deep green. Stems erect, 9–18 dm. tall, branching above, smooth and glabrous almost to the heads: leaves below the inflorescence in whorls of 3's; blades firm, broadly linear or linear-lanceolate, 8–12 cm. long, somewhat acuminate, entire, revolute, shagreen-like above, sparsely pubescent beneath, nearly sessile or narrowed into short petioles: peduncles strigillose-hispidulous under the heads: heads showy: involucres campanulate-turbinate, barely 1 cm. high: bracts narrowly linear-lanceolate, ciliolate, otherwise glabrous, somewhat spreading: rays deep yellow, oblong, about 2 cm. long: disks about 1.5 cm. broad: disk-corollas 5 mm. long, triangular-ovate: disk-bracts slightly keeled, pubescent and ciliate at the apex, prolonged into 1 or 2 sharp teeth: achenes about 5 mm. long.

In wet sandy soil, western Tennessee. Summer.

The prolific flora of Tennessee makes it necessary to add another member to the genus *Helianthus*. The specimens in question were collected by Prof. L. M. Bain at Henderson, Tennessee, in August, 1892, no. 288. *Helianthus verticillatus* is related to *Helianthus giganteus*, but is easily distinguished by the smooth and glabrous stem, the narrower entire smoother leaf-blades and the narrowly linear-lanceolate bracts of the involucres.

HELIANTHUS GLAUCUS.

Perennial, deep green. Stems erect, 9–18 dm. tall, widely branching, smooth, glabrous and glaucous: leaves opposite; blades somewhat leathery, firm, lanceolate, acuminate, sharply serrate, very scabrous above, tomentulose beneath, narrowed into short-margined petioles: heads rather small: involucres campanulate, 8–10 mm. high: bracts few, lanceolate or oblong with a lanceolate tip, more or less strongly spreading, white-ciliate: rays yellow, oblong, 1–1.5 cm. long, often 5–7: disk becoming 1 cm. broad: disk-corollas 4 mm. long; segments lanceolate to oblong-lanceolate: disk bracts commonly 3-toothed at the apex, minutely pubescent: achenes 3–3.5 mm. long, oblong-obovoid, with 2 slender barbed teeth.

In dry sandy soil, North Carolina to Georgia and Florida. Summer and fall.

During my collecting trips in various parts of the Southern States I have met with a peculiar species of *Helianthus* for which no provision is made in any of our descriptive works. The species is most closely related to *Helianthus Schweinitzii* from which it differs in the smooth and glaucous stems, the more finely tomentulose lower surfaces of the leaf-blades and the smaller heads and narrower involucres with their broader and shorter bracts, many of these usually recurving about the middle. Typical specimens were collected by the writer on Dunn's Mountain, Rowan County, North Carolina, August, 1894; Stone Mountain and vicinity, Georgia, and on Little Stone Mountain, Georgia, September, 1894.

HELIANTHUS POLYPHYLLUS.

Perennial, deep green. Stems erect, 9–20 dm. tall, branching above, often stout, densely hirsute near the base, glabrous and often smooth above: leaves numerous; blades narrowly linear, 5–16 cm. long, entire, strongly revolute and apparently thick-filiform, curved: heads showy, few or numerous: involucres somewhat foliaceous: bracts linear-subulate, attenuate into subulate tips, about 1 cm. long, some drooping or recurving: rays yellow, narrowly oblong, 1.5–2 cm. long, readily shriveling: disks 1–1.5 cm. broad, depressed: disk-corollas 3 mm. long; segments triangular: disk bracts with a lanceolate or more slender middle tooth and one or more lateral ones: achenes oblong-cuneate, 3 mm. long, striate, glabrous, awnless.

In thickets, Georgia. Fall.

The Stone Mountain district or, probably more correctly, the granite region of Georgia now has its already large endemic flora increased by an additional species of *Helianthus.* The species in question was collected by the writer in thickets along meadows between Stone Mountain and Little Stone Mountain, Georgia, and also near Loganville in the same state, during September 1894. *Helianthus polyphyllus* is related to *Helianthus angustifolius.* Diagnostic characters exist in the stem which is densely hirsute near the base and glabrous above, in the numerous leaves with their very narrow perfectly revolute blades and in the heads, all parts of which are smaller and much more delicate than in the case of *Helianthus angustifolius.*

BIDENS NASHII.

Annual, glabrous. Stems erect, 10–20 dm. tall, more or less branched : leaves opposite ; blades thickish, oblong to oblanceolate-oblong, 4–10 cm. long, acute, remotely and shallowly serrate, somewhat dilated at the base, sessile, upper slightly connate-perfoliate, somewhat fleshy : heads showy : involucral bracts various, outer foliaceous, linear to spatulate, unequal in length, inner more or less colored, elliptic or oval, shorter than the outer : rays deep yellow, oblong or broadly oblong-obovate, 2–2.5 cm. long : disks 1.5–2 cm. broad : achenes narrowly cuneate, 3.5–4 mm. long, with a few retrorse hairs in margins and two subulate erect awns.

In low grounds, Florida to Louisiana. Summer.

Although the above described species was long ago* recognized as more or less distinct from *Bidens chrysanthemoides* it has never been described under a distinctive name, as far as I can learn. There can be no doubt that it is specifically distinct from other members of the genus *Bidens.* Besides the specimen from Louisiana collected by Dr. Hale and cited by Torrey & Gray, we have good specimens from Florida collected by Dr. Chapman and also by Mr. Nash, no. 2336. From *Bidens chrysanthemoides* it differs in the fleshy and very smooth foliage, the short and broad remotely and hollowly toothed leaf-blades. The heads are larger and the rays usually longer and broader than those of its relative.

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* T. & G. Fl. N. A. **2** : 353.

MARSHALLIA LACINARIOIDES.

Perennial, somewhat pubescent, 3–4 dm. tall. Stems erect, sparingly branched above, leafy to near top, angled: leaves numerous, alternate, basal and those on lower part of stem 10–20 cm. long, with linear or sometimes broadly linear blades, these attenuate at the ends, prominently 3-nerved, entire, narrowed into margined petioles, other leaves with narrowly linear sessile blades, 1.5–6 cm. long, peduncles 5–9 cm. long, slender: heads small, few-flowered: involucres about 5 mm. high: bracts rigid, linear, attenuate, winged below the middle: corollas 7–8 mm. long, villous; segments linear, nearly as long as the tube.

In the low country, North Carolina to Georgia.

Marshallia lacinarioides makes the fifth species for the genus. It is related to *Marshallia graminifolia*,* but its habit is very suggestive of that of some species of *Lacinaria*, whence the specific name. It may be distinguished by the erect elongated basal leaves with their prominently 3-nerved blades. The campanulate involucres are about one half the size of those of *Marshallia graminifolia* and the heads contain but few flowers.

The original specimens were collected at Macon, Georgia, by Mr. Croom, and in North Carolina [eastern] by Mr. M. O. Curtis.

II. THE NORTH AMERICAN SPECIES OF MELOTHRIA.

That we have three species of *Melothria* instead of one in Florida is very evident from material in Mr. Nash's rich collections. So far as I can learn the first and second species following the appended key have never before been described. According to the collector they are native and very plentiful where found.

MELOTHRIA L. Sp. Pl. 35. 1753.

Key to the Species.

Berries globose. 1. *M. Nashii.*
Berries oblong or oval.
    Stems trailing and creeping; leaves broader than long, the lobes low and rounded. 2. *M. crassifolia.*
    Stems climbing; leaves longer than broad, the lobes angular. 3. *M. pendula.*

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* *Athanasia graminifolia* Walt. Fl. Car. 201. 1788.
Persoonia angustifolia Michx. Fl. Bor. Am. 2: 104. 1803.
Marshallia angustifolia Pursh. Fl. Am. Sept. 520. 1814.

1. MELOTHRIA NASHII.

Perennial, slender, rough-pubescent. Stems trailing and creeping, 3–12 dm. long, branched, angled: leaves fleshy, suborbicular or triangular-ovate in outline, 2–3.5 cm. broad, usually 5-lobed, very rough on the surfaces, the lobes entire or with 1–2 teeth or small lobes; petioles hispid, about as long as the blades: flowers monoecious, the sterile in long-peduncled corymbs, the fertile on solitary long peduncles: calyx campanulate, minutely hispid; teeth triangular, acute, several times shorter than the tube: corolla-segments longer and narrower than the calyx-teeth: stamens included; anthers pubescent at the tips, nearly sessile: berries globose, 12–15 mm. in diameter, their peduncles about 3 cm. long.

In sandy soil about Tampa, Florida. *Nash*, no. 2469.

2. MELOTHRIA CRASSIFOLIA.

Perennial, with tuberous-thickened roots, rough-pubescent. Stems trailing and creeping, 6–15 dm. long, branched throughout, angled, sparingly pubescent: leaves thick and fleshy, reniform or orbicular-reniform, 2–4 cm. broad, usually with 5 rounded obtuse lobes, which are undulate or shallowly toothed, cordate, the sinus closed or nearly closed; petioles hispid, about as long as the blades: flowers monoecious, the sterile in long-peduncled racemes, the fertile solitary on long peduncles: calyx campanulate, minutely hispid; teeth triangular-ovate, much shorter than the tube, acute: anthers glabrous, nearly sessile: berries oblong, 1.5–2 cm. long.

In moist places about Eustis, Florida. *Nash*, no. 865.

3. MELOTHRIA PENDULA L. Sp. Pl. 35. 1753.

Annual or perennial, slender, sparingly pubescent. Stems high-climbing, branched: leaves thin, drying membranous, suborbicular or ovate in outline, 3–8 cm. broad, with 3–5 angular usually shallowly toothed lobes, both surfaces pubescent with short hairs, cordate, the sinuses open; petioles 1–3.5 cm. long, hispid: flowers monoecious; sterile racemed; fertile solitary, the peduncles about as long as the petioles: calyx glabrous or puberulent, 2 mm. long; tube campanulate, teeth very short: corolla yellow or greenish-white, 3–4 mm. broad, pubescent without, the segments ovate or obovate: berries oblong or oval, 10–25 mm. long, pendulous, dark-purple or blackish: seeds obovoid, 3.5–4 mm. long, flattened.

In swamps and light soil, Pennsylvania to Missouri, south to Florida, Texas, and Mexico.

The three following forms have been segregated as varieties of *Melothria pendula* by Prof. Cogniaux* but they are imperfectly known. When better understood, two of them, and probably all three, will prove to be distinct species.

The appended descriptions and data are mostly taken from Prof. Cogniaux's monograph.*

3a. MELOTHRIA PENDULA CHLOROCARPA (Engelm.) Cogn. in DC. Monog. Phaner. **3**: 587. 1881.

Melothria chlorocarpa Engelm.; S. Wats. Bibl. Ind. 395. 1878.

Fruit yellow, 1.5 cm. long, 1 cm. thick: seeds 5–5.5 mm. long, 3 mm. broad.

In eastern Texas (El. Hall. no. 230. in herb. Boiss.).

3b. MELOTHRIA PENDULA ASPERA Cogn. in DC. Monog. Phaner. **3**: 587. 1881.

Petioles hirsute: leaves 2–3 cm. long and broad, very scabrous on both sides, deeply lobed, lobes oblong, sometimes wholly entire, obtuse; nerves hirsute beneath: fruit and seeds as in the species.

In Florida, along fields near lake Jamony (Rugel in herb. DC.)

3c. MELOTHRIA PENDULA MICROCARPA Cogn. in DC. Monog. Phaner. **3**: 587. 1881.

Stem creeping, filiform: petioles filiform, 1–3 cm. long: leaves slightly lobed, 1.5–3 cm. long and broad, scabrous on both sides: fruit subglobose, 7–8 mm. thick.

In Alabama, Muscle Shoals, Tennessee River (Rugel in herb. Shuttleworth now Brit. Mus., DC., Boiss.).

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* DC. Monog. Phaner. **3**: 325–954.

The Flora of the Lower Susquehanna.

By Thos. Conrad Porter.

(With Map, Plate 349.)

Whilst residing in the city of Lancaster, from the year 1853 to 1866, I did a great deal of botanical exploration along the valley of the Lower Susquehanna, passing over much of the ground visited by Muhlenberg half a century before. The rarer pteridophytes and anthophytes then and there observed and collected are comprised in the following list, with a few additions of a later date.

As an introduction, a brief sketch of the field is given, accompanied by a map, in which the figures appended to the stations indicate their elevation in feet above the sea level.

Below Duncan's Island, where it receives the waters of the Juniata from the west, the general course of the river is southeasterly, and the distance from that point to the Maryland line, measured as the crow flies, about 70 miles. In breadth it varies from two miles to less than one, the average being one. At the cañon-like gorge above McCall's Ferry the channel is very deep and narrow, apparently not more than one hundred yards across. The wider portions of the stream are characterized by an abundance of islands, large and small, some of them under cultivation and others bare or covered with shrubs and trees. Many of them are completely submerged during high freshets. When the summers are hot and dry for a long period the waters become very low, forming, where the fall is not great, extensive, sluggish shallows that furnish excellent nurseries for aquatic plants.

Starting at Duncannon, in Perry County, and going southward, the stations cited in the list succeed each other thus (the number of miles apart being expressed by the figures): To Marysville, 7; Railroad bridge, 2; Harrisburg, 4; Falmouth, 13; Collins' Ferry, 3; Marietta, 8; Chickies, 1; Columbia, 2; Washington Manor, 5: Turkey Hill, 3; Safe Harbor, 2; mouth of the Pequea, 2; Reed's Run, 3; mouth of the Tucquan, 2; Peach Bottom, 10; Maryland Line, 3.

In the first section of the route from Duncannon, the river flows majestically through a mighty gap in the Blue Mountain and its parallel ranges. On the east side of it lies Dauphin County and on the west Perry, south of which Cumberland is reached and then York lower down. Below Dauphin comes Lancaster, and these two counties have their western boundaries at low-water mark on the opposite shores, so that all the islands are included in their territorial limits.

At Falmouth the river enters the region of the South Mountain system, and along its whole course down to the Maryland line is bordered by bold bluffs and high ridges, intersected by numerous ravines.

The conditions here described are all favorable to a rich and diversified flora, and such it, indeed, is. The denizens of the mountains and the interior find pathways toward the sea. For whilst not a few of the plants enumerated have crept up from lower levels, a greater number appear to have come down from higher altitudes, or from the remote western sources of the mighty river. About thirty species of the list belong naturally to the region beyond the Alleghenies, through which the west branch of the Susquehanna finds a passage, drawing its first waters from almost the same levels as streams that descend into the basin of the Ohio. On the other hand, about twenty seem to have been conveyed down from the elevated mountain-plateaus, drained by the tributaries of the North Branch.

LIST OF SPECIES AND THEIR STATIONS.

PTERIDOPHYTA.

1. *Onoclea Struthiopteris* Hoffm. Islands, near Harrisburg and Safe Harbor; McCall's Ferry.

2. *Asplenium angustifolium* Michx. York County, opposite Marietta; Turkey Hill.

3. *Asplenium montanum* Willd. York County, opposite Marietta; ravine at York Furnace; mouth of the Tucquan. On rocks.

4. *Asplenium pinnatifidum* Nutt. Ravine at York Furnace and on rocks above the mouth of the Tucquan.

5. *Asplenium Bradleyi* D. C. Eaton. On rocks, above the mouth of the Tucquan, *Small.*

6. *Cheilanthes lanosa* (Michx.) Watt. On rocks, Safe Harbor and McCall's Ferry.

7. *Equisetum littorale* Kuehlewein. Forster's Island, at Harrisburg, and the island at Safe Harbor. Occurs higher up, on the North Branch. A northern species.

8. *Equisetum fluviatile* L. Islands at Safe Harbor. A mountain species.

9. *Equisetum sylvaticum* L. York County, opposite Marietta; Turkey Hill. Rare.

ANTHOPHYTA.

10. *Pinus Strobus* L. On a large, high, wooded island, at McCall's Ferry.

11. *Pinus pungens* Michx. On the mountain-side, at McCall's Ferry, *Heller.*

12. *Potamogeton zosteraefolius* Schum. Collins' Ferry.

13. *Potamogeton pectinatus* L. Safe Harbor.

14. *Potamogeton lonchites* Tuckerm. Safe Harbor.

15. *Potamogeton Robbinsii* Oakes. Safe Harbor.

16. *Tripsacum dactyloides* L. Safe Harbor; Tucquan Island.

17. *Panicum polyanthes* Schultes (*P. microcarpon* Muhl.) Marysville; Tucquan Island. Rare.

18. *Zizania aquatica* L. Abundant in a large pond above Marietta, where it is visited by reed birds and rail.

19. *Muhlenbergia capillaris* Kunth. Safe Harbor. The only known station in Pennnsylvania.

20. *Sporobolus heterolepis* A. Gr. Peach Bottom, *J. J. Carter.*

21. *Spartina cynosuroides* (L.) Willd. Harrisburg; Collins' Ferry; mouth of the Tucquan.

22. *Eragrostis Frankii* Meyer. On sandy flats, below the mouth of the Pequea.

23. *Eatonia obtusata* (Michx.) A. Gray. Safe Harbor.

24. *Melica mutica* Walt. Safe Harbor. Also on the Schuylkill, at Reading.

25. *Panicularia elongata* (Torr.) Ktze. On Reed's Run. A mountain species.

26. *Uniola latifolia* Michx. Safe Harbor; McCall's Ferry.

27. *Cyperus erythrorhizos* Muhl. Harrisburg, on the islands; Tucquan Island.

28. *Cyperus Lancastriensis* Porter. Safe Harbor; Tucquan; McCall's Ferry.

This is most likely the *Scirpus retrofractus* of Muhlenberg, at least in part.

29. *Cyperus strigosus compositus* Britton. Safe Harbor.

30. *Scirpus fluviatilis* A. Gray. Peach Bottom, *Dr. George Smith.*

31. *Rynchospora cymosa* Nutt. Tucquan Island.

32. *Carex Frankii* Kunth. York Furnace, *J. Crawford.* A specimen or two only found, as also in the streets of West Chester. Occurs in Huntingdon County and west of the Alleghenies.

33. *Carex Shortiana* Dewey. Near Falmouth, *Small.* Very rare. Occurs in Franklin County, near Mercersburg and more common west of the Alleghenies.

34. *Commelina hirtella* Vahl. Above the mouth of the Tucquan; Peach Bottom.

35. *Commelina Virginica* L. Safe Harbor.

36. *Pontederia cordata* L. York County, above Wrightsville; Islands at Safe Harbor.

37. *Heteranthera reniformis* Ruiz & Pavon. York County, above Wrightsville and opposite Safe Harbor.

38. *Stenanthium robustum* S. Watson. Below Peach Bottom, *J. J. Carter.* Also in Clarion County, west of the Alleghenies, *Garber.*

39. *Allium cernuum* Roth. Mouth of the Tucquan.

40. *Erythronium albidum* Nutt. Island, above Harrisburg, *Small;* Turkey Hill, *Garber.*

41. *Trillium grandiflorum* (Michx.) Salisb. Below Peach Bottom, *J. J. Carter.*

42. *Iris verna* L. Below Peach Bottom, *J. J. Carter.*

43. *Habenaria peramoena* A. Gray. Mouth of the Pequea.

44. *Salix lucida* Muhl. Washington Manor, Lancaster County.

45. *Salix fluviatilis* Nutt. York County, above McCall's Ferry. With leaves an inch broad!

46. *Rumex altissimus* Wood. Island at Safe Harbor. It also occurs in Crawford County, west of the Alleghenies.

47. *Polygonum cilinode* Michx. Above Marysville, Perry County. Brought down from the mountain plateaus, where it is common.

48. *Polygonum incarnatum* Ell. Harrisburg; Safe Harbor; Peach Bottom.

49. *Silene alba* Muhl. Safe Harbor; Mouth of the Tucquan; McCall's Ferry. Common on the islands, where Muhlenburg, no doubt, gathered his first specimens. It belongs west of the Alleghenies and occurs in Armstrong County, Pa.

50. *Sagina apetala* L. Safe Harbor.

51. *Tissa rubra* (L.) Britt. Harrisburg; Safe Harbor.

52. *Nymphaea microphylla* Pers. Collins' Ferry. Brought down from the mountain plateaus.

53. *Magnolia tripetala* L. York County in the ravine back of York Furnace and along the river shore. Also in the ravine at Reed's Run, on the opposite side of the river. Local and not abundant.

54. *Asimina triloba* (L.) Dunal. Common along the river and its tributaries. It is found also on the Juniata and in Huntingdon County at an elevation of 1,400 feet.

55. *Ranunculus Pennsylvanicus* L. f. Chickies.

56. *Cardamine hirsuta* L. York County, opposite Marietta, *Small.*

57. *Cardamine arenicola* Britt. Safe Harbor, *Small.*

58. *Cardamine purpurea* (Torr.) Britt. York shore, opposite Chickies.

59. *Arabis laevigata Burkii* Porter. Duncannon; Harrisburg.

60. *Cheiranthus turritoides* Lam. (*Erysimum cheiranthoides* L.). Harrisburg and Safe Harbor, on the islands.

61. *Polanisia graveolens* Raf. Flats along the river's edge. Common.

62. *Sedum ternatum* Michx. Safe Harbor. Found also on the Juniata and in the western part of the state.

63. *Heuchera pubescens* Pursh. Duncannon; Safe Harbor. On rocky bluffs. Common on the Juniata.

64. *Itea Virginica* L. Collected at one point only, in Cumberland County, by McMinn.

65. *Rubus strigosus* Michx. Collins' Ferry. Abundant on the mountains further north.

66. *Rubus Baileyanus* Britton. Above Chickies, *Small.*

67. *Rubus cuneifolius* Pursh. Peach Bottom.

68. *Potentilla arguta* Pursh. Safe Harbor. Rare. A northern species.

69. *Ulmaria rubra* Hill. New Texas, *J. J. Carter.* A western species.

70. *Rosa blanda* Ait. Marysville, Perry county; McCall's Ferry, *Heller.*

71. *Robinia Pseudacacia* L. Frequent along the shores, especially in York county, where it appears to be native, the progeny of seeds brought down from the Juniata.

72. *Crotolaria sagittalis* L. Collins' Ferry, Tucquan Island.

73. *Meibomia sessilifolia* (Torr.) Ktze. Mouth of Reed's Run.

74. *Lathyrus venosus* Muhl. Duncannon, *Garber*; York Furnace, *Brinton.*

75. *Strophostyles helvola* (L.) Britt. Collins' Ferry; Tucquan; McCall's Ferry; New Texas.

76. *Geranium columbinum* L. Safe Harbor.

77. *Phyllanthus Carolinensis* Walt. York county, above Wrightsville; McCall's Ferry.

78. *Euphorbia commutata* Engelm. Safe Harbor.

79. *Ilex opaca* Ait. Mouth of the Tucquan: McCall's Ferry. It occurs also higher up the river, at Cold Spring, some miles east of Dauphin.

80. *Euonymus Americanus* L. Peach Bottom.

81. *Acer spicatum* Lam. York County, opposite Safe Harbor. A mountain species.

82. *Vitis rupestris* Scheele. Harrisburg: Collins' Ferry.

83. *Sida hermaphrodita* (L.) Rusby. York County, Lockport, opposite Safe Harbor, the only station known in Pennsylvania. It has held its own there for many years, but does not spread much.

84. *Hibiscus Moscheutos* L. Harrisburg, Wetzel's Swamp; Collins' Ferry. Rare.

85. *Hibiscus militaris* Cav. Safe Harbor; Tucquan. On the islands, near the water.

86. *Ascyrum hypericoides* L. Tucquan Island; McCall's Ferry.

87. *Hypericum Ascyron* L. Harrisburg, on the islands, *Small.*

88. *Hypericum prolificum* L. Frequent along the river shores.

89. *Hypericum ellipticum* Hook. Safe Harbor.

90. *Viola rotundifolia* Michx. York County, opposite Safe Harbor. A mountain species.

91. *Viola villosa* Walt. York Furnace, *J. Crawford.*

92. *Passiflora lutea* L. Safe Harbor; Tucquan Island. Also west of the Alleghenies.

93. *Opuntia Opuntia* (L.) Coulter. Peach Bottom. It occupies a space of several yards square, near the top of a rocky hill, at the head of a large island and is found also in a similar habitat at the Delaware Water Gap.

94. *Rotala ramosior* (L.) Koehne. Chickies and the York County shore opposite, and further down.

95. *Kneiffia linearis* (Michx.) Small. Mouth of the Tucquan.

96. *Proserpinaca palustris* L. Harrisburg.

97. *Myriophyllum spicatum* L. In the river at Harrisburg.

98. *Oxytropis rigida* (L.) Britt. Harrisburg, on the islands.

99. *Cicuta bulbifera* L. Collins' Ferry.

100. *Hydrocotyle ranunculoides* L. f. York County, above Wrightsville; Harrisburg; Collins' Ferry.

101. *Erigenia bulbosa* Nutt. York County, above Wrightsville. A western species.

102. *Azalea arborescens* Pursh. Marysville, Perry County, *Small*; Tucquan Island, where I found in 1864, under a large overhanging rock, a small bush of it bearing a profusion of fragrant, snow-white blossoms.

103. *Rhododendron maximum* L. McCall's Ferry. Abundant in all the large ravines along the river.

104. *Picris Mariana* Benth. & Hook. Below Peach Bottom.

105. *Lysimachia vulgaris* L. York Furnace, *Brinton.*

106. *Dodecatheon Meadia* L. Duncannon, *Garber*; Bridgeport, opposite Harrisburg; Safe Harbor. Also on the Conestoga, near Lancaster.

107. *Diospyros Virginiana* L. Common on the banks and islands all along the lower part of the river, sometimes producing an abundance of fruit when a shrub but a few feet high.

108. *Chionanthus Virginica* L. York Furnace; Peach Bottom. Also higher up the river.

109. *Vincetoxicum obliquum* (Jacq.) Britt. Safe Harbor; Tucquan Island. Rare.

110. *Ipomaea lacunosa* L. Safe Harbor; Tucquan Island; Peach Bottom.

111. *Cuscuta Cephalanthi* Engelm. Harrisburg, on the islands; above Marietta; Safe Harbor.

112. *Cuscuta Polygonorum* Engelm. Harrisburg, on the islands; above Marietta; Safe Harbor.

113. *Phlox paniculata* L. Below the mouth of the Pequea. Probably not escaped from culture.

114. *Hydrophyllum Canadense* L. Turkey Hill, above Safe Harbor; Peach Bottom, on a high hill at the head of an island. A northern species.

115. *Microcalyx Nyctelea* (L.) Ktze. Duncannon; Marietta; Safe Harbor.

116. *Phacelia dubia* (L.) Small. Duncannon; Safe Harbor; Tucquan.

117. *Phacelia Purshii* Buckley. Safe Harbor. A western species.

118. *Physostegia denticulata* (Ait.) Britt. Harrisburg; Safe Harbor; Peach Bottom.

119. *Gerardia Skinneriana* Wood. Below Peach Bottom. *J. J. Carter.*

120. *Catalpa Catalpa* (L.) Karst. Not infrequent along the river. May have escaped from culture.

121. *Ruellia strepens* L. Safe Harbor.

122. *Lippia lanceolata* (Ait.) Britt. Harrisburg; Safe Harbor; Peach Bottom.

123. *Dianthera Americana* L. Very abundant, and acres of it in the shallows of the river north of the railroad bridge above Harrisburg, where it nourishes large beds of *Cuscuta Gronovii*, whose vivid orange color attracts the notice of travelers crossing in the cars during the months of August and September.

124. *Diodia teres* Walt. Chickies; Peach Bottom.

125. *Micrampelis lobata* (Michx.) Greene. Islands below Harrisburg.

126. *Sambucus pubens* (Michx.) Chickies. York County, opposite Safe Harbor. A mountain species.

127. *Elephantopus Carolinianus* L. Below Peach Bottom.

128. *Eupatorium rotundifolium* L. Island at McCall's Ferry.

129. *Eupatorium hyssopifolium* L. Collins' Ferry; McCall's Ferry.

130. *Eupatorium Torreyanum* Short. Collins' Ferry.

131. *Eupatorium coelestinum* L. Safe Harbor.

132. *Willoughbya scandens* (L.) Ktze. Mouth of the Pequea.

133. *Chrysopsis Mariana* (L.) Nutt. Peach Bottom.

134. *Solidago puberula* Nutt. York County, opposite Marietta. Probably brought down from the mountain-plateaus of Luzerne County where it and the following species abound.

135. *Solidago odora* Ait. Tucquan Island; McCall's Ferry.

136. *Solidago Canadensis glabrata* Porter. Below the mouth of the Tucquan, *Small.*

137. *Solidago Purshii* Porter. McCall's Ferry, on the York County shore, where it was discovered by me in 1864. It grows near the river's edge on rocks, subject to inundation and in similar habitats elsewhere—on Onion River, Vermont, at the Great Falls of the Potomac and on the Yadkin River, North Carolina.

138. *Boltonia asteroides* L'Her. Harrisburg, on the islands; Collins' Ferry; Safe Harbor; mouth of the Tucquan. Common on rocks near the water's edge.

139. *Aster Pringlei* Britt. On the river flats near Harrisburg; Safe Harbor; mouth of the Tucquan.

140. *Aster multiflorus* Ait. Safe Harbor.

141. *Baccharis halimifolia* L. Below Peach Bottom. *J. J. Carter.*

142. *Polymnia Canadensis* L. York county, opposite Marietta; Safe Harbor.

143. *Polymnia Uvedalia* L. Turkey Hill; Tucquan Island.

144. *Silphium trifoliatum* L. McCall's Ferry, *Garber.* A western species.

145. *Chrysogonum Virginianum* L. Below Peach Bottom, *J. J. Carter.*

146. *Eclipta alba* (L). Hassk. Harrisburg; Chickies; Safe Harbor; on the river flats.

147. *Helianthus tuberosus* L. Safe Harbor. Common along the river, where it is undoubtedly native. When escaped from cultivation, as is sometimes the case, the escape is easily distinguished by the practised eye.

148. *Verbesina alternifolia* (L.) Britt. Harrisburg. Common and abundant along the river and along its smaller tributaries.

148. *Coreopsis tripteris* L. Marysville; mouth of the Tucquan. A western species.

150. *Mesadenia reniformis* (Muhl.) Raf. Tucquan Island. It occurs also on the Juniata.

151. *Synosma suaveolens* (L.) Raf. Below the mouth of the Pequea. Also in the counties west of the Alleghenies.

152. *Arnica acaulis* (Walt.) B.S.P. Below Peach Bottom, *J. J. Carter.*

153. *Carduus nutans* L. Harrisburg.

Specimens of all the plants from the stations named in this list are contained in the Pennsylvania Herbarium of Lafayette College.

An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886.—XXIV.

By H. H. Rusby.

(Continued from the last contribution by Dr. N. L. Britton, Bull. Torr. Bot. Club, **20**: 140. 1893.)

Note.—Soon after the publication of the last part of this Enumeration, in 1893, Dr. Britton became so engrossed in the important duties which have since culminated in the publication of the Illustrated Flora, and in the establishment of the New York Botanical Garden, that the continuation of this work was impossible. Up to a recent period, Dr. Britton hoped to resume the publication, but, seeing now that this is impracticable, he has asked the present writer to undertake the completion of the task. The succeeding parts will be published in the Bulletin from month to month, as regularly as the circumstances will permit. Meanwhile, the MS. for the Enumeration of the remaining plants of Mr. Bang's collections is being prepared coincidently and will shortly form a part of the *Memoirs*.

APOCYNACEAE.

Rauwolfia ternifolia H.B.K. Nov. Gen. et Sp. **3**: 232. Junction of Rivers Beni and Madre de Dios, Aug., 1886. A shrub. (Nos. 2388 and 2389).

Aspidosperma ramiflorum Muell. Arg. in Mart. Fl. Bras. **6**^{1}: 55. (*Fide* Britton.) Guanai, 2000 ft., May, 1886 (no. 2649).

Tabernaemontana laeta Mart. Flora **20**: Beibl. 98. 1837. Junc. of Rivers Beni and Madre de Dios, Aug., 1886 (nos. 929?, 930 and 2378).

Tabernaemontana undulata Vahl. Eclog. Am. **2**: 20. Falls of Madeira, Brazil, Oct., 1886 (no. 2396). The same as Holton's no. 445 from New Granada.

Stemmadenia mollis Benth. Bot. Voy. Sulph. 125. Guayaquil, Ecuador, Feb., 1895 (no. 931).

Forsteronia pubescens A. DC. Prod. **8**: 436.

Junction of Rivers Beni and Madre de Dios, Aug., 1886 (no. 2526).

Secondatia densiflora A. DC. Prod. **8**: 445. (*Fide* Britton.) Falls of Madeira, Brazil, Oct., 1886 (no. 2392).

Laubertia sp. (?), Beni River, July, 1886 (no. 2599).

This curious specimen, which Dr. Britton thought might belong to *Condylocarpon*, to me presents the aspect of a *Laubertia*; but it is in fruit and the fruit of *Laubertia* is not known.

Echites brachyloba Miers, Apocyn. S. Am. 203 (*Amblyanthera brachyloba* Muell. Arg. Linnaea, **30**: 423. 1859–60). Mapiri, 2500 ft., May, 1886 (no. 2585). The same as Mathew's no. 820.

Echites sps. Nos. 2383, 2390 and 2393 belong to this genus, but none are in a fit state for a positive determination. The first may be a form of *E. trifida* Jacq.

Dipladenia, species apparently undescribed. Reis, Bolivia, 1500 ft., June, 1886 (no. 2694).

MANDEVILLA BOLIVIANA (Britton). (*Echites Boliviana* Britton ex Rusby, Mem. Torr. Bot. Club, **4**: 219). Guanai, 2000 ft., May, 1886 (no. 2380), Yungas, 4000 ft. (no. 2381) and Mapiri, 5000 ft., April, 1886 (no. 2382). The type is Bang's no. 1687.

MANDEVILLA MANDONI sp. nov.

Glabrous, except the lower leaf-surfaces: branches terete, slender, purple, the internodes 1–1.5 dm. long: petioles 1–1.5 cm. long, stoutish, purple; blades 8–10 cm. long, 4–6 cm. broad, cordate, abruptly acuminate and very acute, finely soft-tomentose and finely reticulate underneath, the venation not prominent: peduncle pseudo-axillary, 1 dm. long, stoutish; the raceme loose, about 8–15-flowered; pedicels about 2.5 cm. long, the bracts 5–7 mm. long, subulate, weak, deciduous: calyx 1 cm. long, cleft to the base, the segments narrow, tapering from the base to an acute point: corolla hypocrateriform, the tube nearly cylindrical, 2.5–3 cm. long, 5 mm. broad, as pressed, the limb imperfect in the specimen, apparently 2–2.5 cm. broad.

Sorata, 8000 ft., Feb., 1886 (no. 2386). Very near *M. Bangii*, but the form, texture and indumentum of the leaves is quite distinct. Dr. Britton thinks it identical with Mandon's no. 1472, which I have not seen.

Nos. 2379 and 2394 are apparently in this genus, but are unfit for diagnosis.

ASCLEPIADACEAE.

Mitostigma niveum Griseb. in Goett. Abhand. **24** : 226. 1879. Sorata, 8000 ft., Feb., 1886 (no. 2517).

Dr. Britton finds this plant to be the same as Mandon's no. 357, which is thus named by Grisebach.

Mitostigma sp. (?) Material for dissection is wanting. Guanai, 2000 ft., May, 1886 (no. 2544).

Amblyostigma pedunculare Benth. Hook. Icon. Pl. **12** : 77. Mapiri, 2500 ft. May, 1886 (no. 1048). According to Miss Vail, this is the same as Mandon's no. 352, on which the species was founded.

Oxystelma solanoides (H.B.K.) K. Schum, in Eng. & Prantl Nat. Pfl. Fam. **4**^{2} : 229. (*Philibertia solanoides* H.B.K. Nov. Gen. et Sp. **3** : 197. *pl. 230.*) Yungas, 4000 ft. 1885 (no. 1973). The same as Bang's no. 1815.

Fischeria Martiana Decaisne in DC. Prod. **8** : 601, Beni River, July, 1886 (no. 936).

Gothofreda Dombeyana (Decaisne) Kuntze Rev. Gen. Pl. 420 (*Oxypetalum Dombeyanum* Decaisne in DC. Prod. **8** : 583) Guanai, 2000 ft., May, 1886 (no. 934). The same as Bang's no. 1395.

Asclepias nervosa Decaisne in DC. Prod. **8** : 568. (*Fide* Dr. Britton.) Yungas, 6000 ft., 1885 (no. 935).

Metastelma (Eumetastelma) Mathewsii sp. nov.

Branches twining, elongated, slender, sparingly puberulent toward the tip, green, terete, the internodes extremely variable in length : petioles slender, 1 cm. or less long, flattened or slightly channelled above, sparingly puberulent ; blades 2.5–6 cm. long, 1–2 cm. broad, lance-oblong, the base obtuse to rounded, the apex aristate, glabrous or sparingly short-pilose when young, deep green, the midrib stout and very prominent underneath, the primaries 10–12 unequal pairs, interconnecting two thirds of the way to the margin : inflorescence pubescent ; peduncles mostly less than 5 mm. long, weak : flowers umbellate, 3–8, the pedicels minutely short-bracted at the base, about as long as the peduncle and similar to it : calyx 2–3 mm. broad, divided more than half way, the lobes broadly ovate, acute, green with broad hyaline margins : corolla greenish-white, open, campanulate, divided three fourths of the way to the base, the lobes 3 mm. long, 1.5 mm. broad, triangular-ovate, somewhat obtuse; gynostegium 2 mm. long, 1 mm. broad, nearly sessile; crown of 5 slender, subulate, white, strongly incurved teeth, lightly adnate to the base of the stamen column: caudae of the anthers whitish, corneous, acute, projecting, nearly as long as the body; apical appendages hyaline, erect, about equaling the stigma; corpuscles dark brown, erect, ellipsoidal or slightly broader above, about half the size of the pollinia, which are pendulous on nearly horizontal thick arms, obovoid, compressed: stigmatic disk slightly convex.

Yungas, 6000 ft., 1885 (no. 2543).

The species appears externally the same as Mathew's no. 3144 from Chachapoya, though less puberulent. It is, by dissection, the same as Bang's no. 2090.

TASSADIA SPRUCEI sp. nov.

(Only a short terminal portion of a flowering branchlet seen.) Subglabrous, only the youngest portions of the slender stems minutely puberulent: petioles 5–8 mm. long; blades 3.5 cm. or more long, 1.5 cm. or more broad, ovate, the base rounded, the apex abruptly short-acuminate, the obtuse point short-aristate, margin thinly revolute, thick, coriaceous, midrib and 3 or 4 pairs of primaries prominent underneath: racemes axillary, slender, nearly 1 dm. long, the peduncle ⅓–½ of the length: the flowers in sessile umbellules of 3–5, sub-pendulous on slender pedicels about 2 mm. long: calyx 1.5 mm. broad, divided more than half way, the lobes ovate, acutish, thick, purple (?) with lighter margins: corolla very broadly campanulate, 3 or 4 mm. broad, purple, thick, the lobes about two-thirds the length, ovate, obtuse, the tips spreading or slightly recurved. Material for dissection wanting.

Falls of Madeira, Brazil, Oct., 1886 (no. 2573). The same as Spruce's no. 3295.

DITASSA RACEMOSA Britton sp. nov.

Glabrous, the branches terete, much elongated and very slender, the internodes 3–6 cm. or more long: petioles 5–7 mm. long, stoutish, flattened, recurved; blades 3.6 cm. long, .5–1 cm. broad, lanceolate, slightly inequilateral, the base rounded to slightly cordate, the apex acuminate and acute, dark green, the venation not prominent, much reticulate: racemes 1 to nearly 2 dm. long, occasionally sparsely branched, very slender, pendulous, the flowers mostly solitary, .5–1 cm. apart, the pedicels bracted at the base, about 5 mm. long, strongly curved; bracts about 5 mm. long, ovate, thickish: calyx 3 mm. broad, lobed nearly to the base, the lobes narrowly ovate, obtuse or minutely apiculate: corolla white, coarsely pilose at the base within, 6 mm. broad, lobed two thirds of the way, the lobes ovate, obtuse: outer crown adnate to the base of the filaments, of 5 lanceolate, long-acuminate, concave, whitish, thin and delicate ligules, which are 3 mm. long, erect, recurved, and the apex again erect: the inner more highly adnate, less than half as long, of 5 rigid broad scales, bearing a narrow short apical appendage: gynostegium nearly sessile, broader above: apical anther appendage hyaline, delicate, very broadly ovate, erect: corpuscles not appendaged, broadly ovoid, obtuse, erect, the pollinia ovoid; lightly compressed, pendulous, on nearly horizontal slender caudiculae: stigmatic disk .5 mm. broad, convex, fleshy-thickened.

Yungas, 4000 ft., 1885 (no. 2546). The same as Bang's nos. 2140 and 2845. Also collected by Pearce at Coroico, 5000–6000 ft., Feb., 1886.

Ditassa aristata Benth. ex Fourn. in Mart. Fl. Bras. **6**^{4}: 247. (*Fide* Britton). Mapiri, 2500 ft., May, 1886 (no. 1046).

VINCETOXICUM UNGUICULATUM (R. & P.) Britton.

(*Cynanchum unguiculatum* R. & P. in Herb. Kew.)

Roughish-pubescent throughout, the hairs of the stem retrorse: stems stoutish, twining, much-branched, green, the internodes 1.5–4 cm. long: petioles 3–7 mm. long, broad and stout; blades 2–4 cm. long, 1–1.5 cm. broad, ovate, the base rounded, the apex short-acuminate and acute, thick (and fleshy?), substrigose above, the hairs upon the veins underneath much longer and coarse: flowers densely clustered in the axils, the stout pedicels at length (and in fruit) 7 mm. long: calyx 3 mm. broad, divided two-thirds of the way, the lobes narrowly ovate, acuminate and acute, the sinuses broad, thick, brown: corolla 5 mm. broad, sub-rotate, densely pilose within, white, divided two-thirds of the way, the lobes ovate, obtusish; crown adnate only to base of filaments, nearly as long as the gynostegium, single, of 5 erect lobes which are broader than long, penicillate at the apex, keeled, the edges of the two adjacent meeting and turned outward, rigid: pollinia small, but little larger than the brownish corpuscle: fruit 6 cm. long, narrowly lanceolate and acuminate, smooth.

Unduavi, 8000 ft., Oct., 1885 (no. 1044) and Yungas, 4000 ft., (no. 2518).

GONOLOBUS BRITTONII sp. nov.

Pubescent throughout, the branches terete, elongated, slender, twining: petioles 1.5–2 cm. long, slender; blades 2.5–5 cm. long, 1–2 cm. broad, ovate, the base cordate-truncate, the apex abruptly short-acuminate, acutish, strigose, subferruginous on the veins underneath: umbels about 5-flowered, on peduncles about 1 cm. long; pedicels very unequal, the longest about 1 cm. long, about the same in fruit: calyx-tube very short, saucer-shaped, the lobes 2 mm. long, ovate, obtuse: corolla subrotate, 8 mm. broad, divided more than half way, very veiny, the lobes ovate, obtusish; outer crown 2 mm. broad, adnate to the base of the corolla except for a short free annulus, light-colored; inner crown shorter, of 5 ovate thick scales, adnate at the base to the outer: stigmatic disk plane, the center minutely elevated, thin, 2 mm. broad exclusive of its appendages, its 5 dark grooves terminating at the margin in minutely recurved tooth-like points, these connected by slightly elevated, sharp, light-colored ridges which form the bases of triangular lobes, twice as broad as long, each terminating in a transversely elliptical appendage about .5 mm. broad: pod broadly ovoid, inequilateral, obtuse (?) smooth, nearly 1 dm. long.

Mapiri, 2500 ft., May, 1886 (no. 1045).

The species differs from *G. parviflorus* Decaisne in having peduncles shorter than the petioles, and the corolla not barbellate within.

VAILIA gen. nov. (Marsdenieae).

Calyx 5-lobed, its glands wanting or indistinguishable, the segments obtuse. Corolla broadly campanulate, deeply 5-lobed, glabrous, the lobes obtuse. Crown adnate only to stamen-column, of 5 scales, each of an outer and an inner ligule, the two adnate by their margins at the base to form a pouch: the outer ligule inwardly concave, free, except the margins at the base; the inner ligule outwardly concave, the lower half, except the margins, adnate to the stamen-tubes, the upper half free. Anthers with stout, obtuse, rigid, empty basal portions adnate to one another, except at the very base, and to the tube, constituting more than half their length, their hyaline apical appendages very small, strongly inflexed, broad, slightly exceeding the disk of the stigma; lateral hyaline appendages also present upon the inner face; thecae rupturing transversely on the inner face. Pollinia solitary, large, marked in the unopened anther by large external protuberances, strictly erect, quite as high as the stigmatic margin, broadly ellipsoidal, their uppermost portions higher than the oblong, unappendaged corpuscle, the caudiculae somewhat thickened, regularly curved.

(*To be continued.*)

New Species of Fungi from various Localities.

BY J. B. ELLIS AND B. M. EVERHART.

CHAETOMIUM ABIETINUM E. & E.

On the end of a stick of firewood (*Abies excelsa*) exposed to the weather through the summer. Newfield, N. J., Dec., 1897.

Perithecia crowded, ovate-globose, finally more or less collapsing above, .35–.5 mm. in diameter, densely clothed above with black simple, spine-like continuous bristles 60–75 μ long and 4–5 μ thick at the base: asci cylindrical, short-stipitate, aparaphysate, p. sp. 65–75 × 12 μ: sporidia uniseriate, globose, subhyaline at first, becoming opaque, mostly with a single nucleus, 8–10 μ in diameter, only slightly compressed.

Allied to *C. sphaerospermum* C. & E. but bristles not branched and sporidia rather larger and only slightly compressed.

CORDYCEPS CANADENSIS E. & E.

Growing on *Elaphomyces*, London, Canada (Dearness, no. 2641).

About 6 cm. high, head elliptical, 6×4 mm. (dry), dark-colored: stem yellow, attenuated at the summit, about 3 mm. thick below: perithecia ovate, peripheral, about 6×4 μ, their apices slightly prominent, roughening the surface of the head with hemispherical protuberances: asci slender, 300–325 × 7–8 μ: sporidia filiform, nearly as large as the asci, separating into cylindrical segments, 10–20 (mostly about 15) × 2–2.5 μ, hyaline.

When fresh, the whole plant is of a light yellow color throughout. The slender cylindrical segments of the sporidia are only about half as long and wide as in *C. capitata* (Holmsk.) and very different from the globose-ellipsoid joints of the sporidia of *C. ophioglossoides* (Ehr.).

COPROLEPA GIGASPORA E. & E.

On cow dung, Rocky Mts., British Columbia, June, 1897 (Macoun, no. 684).

Stromata scattered, small (2–4 mm.) convex-prominent, black outside, the surface roughened by projecting cells and imperfectly developed rudimentary brown hairs, inside about the color and consistency of cork: perithecia buried in the stroma either singly or in the larger stromata 2–4 in a stroma, ovate-globose, .75 mm. in diameter, attenuated above, with the hemispherical, soon perforated ostiolum erumpent and surrounded at the base by the thin margin of the superficial layer of the perforated stroma: asci cylindrical, 230–320 × 35–40 μ, with abundant stout paraphyses, 4–8-spored: sporidia uniseriate or subbiseriate, oblong-elliptical, subhyaline at first with a broad hyaline envelope and a small tubercular or sometimes short-pointed appendage at the lower end, finally opaque, 45–60 × 20–22 μ.

MELANOMMA NITIDUM E. & E.

On bark of *Artemisia tridentata*, Grand Junction, Colo., March, 1898 (Prof. C. S. Crandall, no. 325).

Perithecia superficial, scattered or 2–3 together, globose, somewhat shining, minute (.25–.35 mm.); ostiolum papilliform, minute, soon perforated: asci cylindrical, short-stipitate, paraphysate, 8-spored: sporidia crowded-biseriate, fusoid, brown, 5-septate, scarcely constricted at the septa, slightly curved, tapering from the middle to each obtusely pointed end, 25–32 × 5–6 μ.

M. occidentale Ell. has perithecia larger, rough and only semi-erumpent and sporidia not as distinctly attenuated towards the ends and shorter.

ZIGNOELLA POPULI E. & E.

On decorticated, dead limbs of *Populus angustifolius*, Fort Collins, Colo. (Prof. C. S. Crandall).

Perithecia scattered, erumpent-superficial, depressed-globose, roughish, .5–.75 mm. in diameter, with a small papilliform ostiolum, at length perforated: asci clavate-cylindrical, 75–85 × 12–15 μ: sporidia subbiseriate, clavate-oblong, hyaline, 4-septate, more or less constricted at the septa, 18–22 × 6–8 μ.

ZIGNOELLA LONICERINA E. & E.

On bleached limbs of *Lonicera involucrata*, Mt. Richtophen, Colo., July, 1896 (C. F. Baker, no. 411).

Perithecia scattered, suberumpent, .35–.5 mm. in diameter, subelliptical, convex-hemispherical, base slightly sunk in the wood, ostiolum papilliform, at length perforated: asci clavate-cylindrical; short-stipitate, paraphysate, 50–60 × 6–7 μ: sporidia biseriate, oblong-fusiform, hyaline, 3- (exceptionally 5-) septate, not constricted, 10 13 × 3 μ or sometimes reaching 15 × 3.5 μ.

Z. boreella Karst, *Z. australis* Speg. and *Z. adjuncta* Pass. have similar sporidia but differ otherwise.

TEICHOSPORA OBLONGISPORA E. & E.

On bleached, dead limbs of *Populus angustifolia*, Fort Collins, Colo., April, 1898 (Prof. C. S. Crandall).

Perithecia gregarious, erumpent-superficial, 400 × 600 μ in diameter, soon collapsing to cup-shaped, with a papilliform ostiolum: asci clavate-cylindrical, 80–100 × 14–16 μ, short-stipitate, paraphysate, 8-spored: sporidia biseriate, fusoid-oblong, slightly curved, only slightly constricted at the septa, 5–7-septate, yellowish-brown, 25–30 × 8–10 μ, one or two of the cells divided by a longitudinal septum.

Differs from *T. infuscans* E. & E. on the same host, in its much larger perithecia and sporidia.

TEICHOSPORA NEGUNDINIS E. & E.

On dead decorticated limbs of *Negundo aceroides*, Fort Collins, Colo., Feb., 1898 (Prof. C. S. Crandall).

Perithecia scattered, erumpent-superficial, ovate-globose, finally collapsing, with a papilliform ostiolum, 450–500 μ in diameter: asci cylindrical or clavate-cylindrical, 75–85 × 10–14 μ, short-stipitate, paraphysate, 8-spored: sporidia biseriate, oblong-ovate, 3–5-(mostly 3-) septate, 10–15 × 6–7 μ, exceptionally 15–20 × 8–10 μ.

Teichospora clavispora E. & E. on bark of the same host has perithecia smaller and not collapsing and sporidia 8–10-septate, 30–35 × 10–12 μ.

LOPHIOSTOMA PUSTULATUM E. & E.

On dead shoots of grape vine, Rockport, Kansas, March, 1897 (E. Bartholomew).

Perithecia scattered, globose, about .75 mm. in diam., entirely buried and covered by the bark which is raised into a large hemispherical pustule barely pierced at the apex by the narrow slightly compressed ostiolum: asci cylindrical, 110–130 × 8–10 μ, with abundant paraphyses: sporidia uniseriate, oblong, slightly curved, rounded at the ends, 3-septate, slightly constricted, brown, 20–27 × 6–7 μ.

Comes near *L. quadrinucleatum* Karst.

LOPHIOSTOMA RHOPALOSPORUM E. & E.

On dead shoots of grape vine, Rooks Co., Kansas, March, 1897 (E. Bartholomew).

Perithecia scattered, buried, compressed, 500–600 × 350–400 μ; ostiolum erumpent, extending half way across the slightly erumpent apex of the perithecium, which scarcely raises the bark: asci stipitate, clavate, p. sp. 60–75 × 12 μ, paraphysate, 8-spored: sporidia biseriate, clavate-oblong, 4–5-septate, scarcely constricted, yellow-brown, obtusely rounded above, 20–27 × 6–7 μ.

L. clavisporum E. & E. has the perithecia semierumpent and smaller and the ostiolum narrower and more prominent, but the sporidia are about the same in both.

SPHAERELLA INFUSCANS E. & E.

On old petioles of *Liriodendron tulipifera*, Nuttallburg, W. Va., May, 1898 (L. W. Nuttall, no. 937).

Perithecia gregarious, minute, covered by the thin epidermis which is raised into minute pustules and blackened continuously for one or more cm. in extent; ostiolum conic-papilliform, erumpent: asci oblong-cylindrical, 35–45 × 7–8 μ: sporidia biseriate, fusoid, slightly curved, hyaline, nucleate, becoming faintly uniseptate, but scarcely constricted.

Differs from the description and figures of *S. petiolicola* (Desm.) in its longer fusoid sporidia.

DIDYMELLA CORYLINA E. & E.

On dead stems of *Corylus*, London, Canada (Dearness, no. 2638).

Perithecia scattered, buried in the unaltered substance of the bark which is not discolored or perceptibly raised above them, globose, 350–400 μ in diameter; ostiolum erumpent, papilliform, minute, often at length umbilicate: asci cylindrical, 100–120 × 6–7 μ (p. sp. 75–80 μ long), paraphysate, 8-spored: sporidia oblong, very slightly inequilateral, uniseptate, scarcely constricted, yellowish-hyaline, obtuse, 15–16 × 4.5–5.5 μ.

OPHIOBOLUS INSTABILIS E. & E.

On leaves of *Artemisia biennis*, Racine, Wis., Sept., 1897 (Dr. J. J. Davis, no 978).

Perithecia semi-erumpent, scattered, ovate, 110–150 μ in diameter, with papilliform ostiolum: asci clavate-cylindrical, short-stipitate, obscurely paraphysate, 80–120 × 12–13 μ: sporidia fasciculate, 90–110 × 4–5 μ, 8–10-septate and more or less constricted at several of the medial septa, yellowish, each cell with a single nucleus.

The perithecia are mostly on the leaves but occur also on the partly dead stems.

PLEOMASSARIA MAXIMA E. & E.

On bark of dead *Magnolia*, Brookline, Mass., April, 1893 (Prof. H. L. Jones, no. 30).

Perithecia irregularly scattered or subcircinate, depressed-globose, carnose-membranous, 1–1.25 mm. in diameter, partly sunk in the surface of the inner bark and covered by the epidermis; ostiola erumpent, not united in a disk, tuberculiform, irregularly dehiscent. When the epidermal layer is removed, the ostiola and apex of the perithecia come off with it, leaving the perithecia open with their grayish interior exposed: asci clavate-cylindrical, short-stipitate, 8-spored, 200–260 × 45–60 μ, with abundant paraphyses: sporidia subbiseriate, fusoid-oblong, subacute, 6–15-septate and clathrate-muriform, generally constricted at the middle septum and sometimes at one or more of the other septa, hyaline at first with a broad hyaline envelope, becoming dark-brown, 60–90 (mostly 70–80) × 20–22 μ.

MELANCONIS OBRUTA E. & E.

In bark of dead *Salix*, St. Croix Falls, Wis., Nov., 1897 (C. F. Baker, no. 586).

Conidia (*Melanconium* sp.), stroma convex, thin, 2–3 mm. across, slightly sunk in the surface of the inner bark and erumpent on the epidermis: conidia ovate, nearly opaque, 15–22 × 10–12 μ: ascigerous stroma sunk in the inner bark, depressed-conical, about 1 mm. across, yellowish-white inside: perithecia circinate in the bottom of the stroma, 12–15 in a stroma, ovate-globose, about .25 mm. in diam., their slender necks rising together and piercing the overlying conidial stroma but so encumbered and overwhelmed by the mass of conidia that the character of the ostiola can not readily be seen: asci cylindrical, attenuate-stipitate (paraphysate?), 200–230 × 16–18 μ: sporidia uniseriate, lying end to end, oblong-elliptical, hyaline, becoming olive-brown, uniseptate, obtuse, constricted at the septum, 19–22 × 10–12 μ.

Very different from *M. salicina* E. & E.

FENESTELLA LEUCOSTOMA E. & E.

On dead limbs of *Alnus*, Bay of Islands, Newfoundland, Oct., 1897 (Rev. A. C. Waghorne, no 311^b).

Stromata scattered, orbicular, truncate-conic above, convex below, about 1.5 mm. in diameter, adnate to the inner surface of the epidermis and separating with it, as in *Valsa leucostoma* (Pers.), from which externally this can hardly be distinguished: perithecia 4–6 in a stroma, small (150–200 μ), the minute black papilliform ostiola piercing the minute round snow-white disk which perforates the epidermis and raises it into pustules: asci cylindical, briefly attenuate-stipitate, obscurely paraphysate, 8-spored: sporidia uniseriate, oblong-elliptical, yellow-brown, 5–7-septate, constricted in the middle, obtuse, 20–27 × 12–13 μ.

HOMOSTEGIA ? OBSCURA E. & E.

On dead alders, Bay of Islands, Newfoundland, Oct., 1897 (Waghorne, no. 311).

Stromata thickly scattered, attached to the epidermis and erumpent through it, about .5 mm. in diameter, at first convex, then plane or slightly concave, black, subangular; ascigerous cells obscure: asci cylindrical, short-stipitate, obscurely paraphysate (?), about 80 × 12 μ: sporidia mostly biseriate, clavate-fusoid, 5–6-septate, constricted at the middle septum, hyaline, 20–27 × 5–6 μ.

The ascigerous cavities were not satisfactorily made out, but the character of the stroma is that of the Dothideaceae.

PEZICULA SPICATA E. & E.

On dead twigs of *Acer spicatum*, near Ottawa, Canada, Oct., 1897 (Macoun, no. 404 in part).

Ascomata scattered, erumpent, convex, dull watery-white, .35–.5 mm. in diameter, closely embraced by the ruptured epidermis, concave when dry, with the margin darker and irregularly bent: asci oblong, 60–70 × 12–15 μ, including the short, abrupt stipe: paraphyses stout, slightly thickened at the tips: sporidia 1–2-seriate, globose or ovate-elliptical, 7–10 (mostly about 8 μ) × 6–8 μ, at first with a hyaline envelope.

Differs from *Pezicula acerifolia* Pk. in its scattered growth and smaller asci and sporidia.

DASYSCYPHA ERYNGIICOLA E. & E.

On dead stems of *Eryngium*, near Ottawa, Canada, Oct., 1897 (Dr. John Macoun, no. 581).

Ascomata gregarious, short-stipitate, 1–1.5 mm. in diameter, at first patelliform, becoming shallow cup-shaped, white-tomentose outside, margin fringed with simple white straight obtuse septate minutely roughened hairs 60–70 × 3 μ: asci clavate-cylindrical, 55–60 × 5–6 μ: sporidia cylindrical, continuous, obtuse, straight, 12–15 × 2.5–3 μ: hymenium at first nearly white, becoming light yellow and when dry brownish and occasionally umbilicate.

D. labiata (Rob. & Desm.) has smaller sporidia (10 μ) and smaller (.65–.75 mm) ascomata furfuraceous outside and at first globose.

PHAEOPEZIZA NOVAE-TERRAE E. & E.

On rotten wood, Newfoundland, Sept., 1897 (Rev. A. C. Waghorne, no. 374).

Ascomata sessile with the obtuse margin free, discoid, carnose, friable, black throughout, 1.5–2.5 mm. in diameter, disk slightly concave, sometimes umbilicate: asci cylindrical, mostly curved, attenuate-stipitate, 80–110 × 8–10 μ, 8-spored; paraphyses simple, nucleolate, slightly enlarged at the tips: sporidia uniseriate, short-elliptical, brown, with a single large nucleus, 8–12 × 6–7 μ, mostly 9–10 × 6–7 μ.

CALLORIA KANSENSIS E. & E.

On rotten wood, Kansas (H. F. Roberts).

Gregarious, subgelatinous, pale orange-color, globular and immarginate, about .35 mm. across when fresh, of a rather deeper color and umbilicate when dry, and with spreading white hairs around the base: asci clavate-cylindrical, 65–75 × 8–10 μ, stipitate, aparaphysate, 8-spored: sporidia mostly biseriate, oblong-elliptical, hyaline, with two large nuclei, becoming uniseptate, 8–10 × 4–5 μ.

Remarkable for its different appearance in the fresh and in the dry state. The umbilicus appears like a shallow cylindrical depression and gives one the impression of a cup-shaped ascoma with a regularly incurved margin.

UROMYCES OBLONGISPORUS E. & E.

On leaves of *Artemisia tridentata*, Sweetwater Co., Wyoming, July, 1897 (Prof. Aven Nelson, no. 3546).

III. Sori orbicular, about 1 mm. in diam., flat, black, naked, pulverent, amphigenous: teleutospores oblong or oblong-elliptical, 22–30 × 14–16 μ, epispore smooth or slightly echinulate, especially above where it is slightly thickened, deep chestnut-brown;

pedicels very short (10–12 μ), fragile, hyaline: paraphyses linear-lanceolate, hyaline.

This must be very near *Uromyces Tanaceti* Rabh., but that has broader glabrous spores and no paraphyses.

PUCCINIA SIMILIS E. & E.

On leaves and stems of *Artemisia tridentata*, Sweetwater Co., Wyoming, July, 1897 (Prof. Aven Nelson).

I. Pseudoperidia amphigenous in small clusters on the leaves, erumpent, closed at first, then open with erect pale margin, more or less distinctly incise-toothed, sub-cylindrical, about .5 mm. high, mostly a little narrowed at the base, deep orange below; aecidiospores deep orange, subglobose, 15–20 μ in diameter, epispore thin, nearly smooth. II. Uredospores in flat orbicular dark cinnamon-colored naked sori about 1 mm. across, globose or ovate, chestnut-brown, aculeolate (more distinctly so above), 18–22 μ in the longer diameter. III. Teleutospores in sori like those of the uredospores, but of a deeper color, nearly black, oblong-elliptical, 20–30 × 14–16 μ, slightly thickened above and sparingly echinulate-roughened around the apex; pedicels stout, hyaline, 80–100 μ long, attenuated below.

Differs from *P. Tanaceti* DC. in its larger, thinner, flatter, darker-colored sori and in the presence of an *Aecidium*.

RAVENELIA MESILLIANA E. & Barthol.

On leaves of *Cassia bauhinioides*, near Mesilla, New Mexico, Oct., 1897 (E. O. Wooton). Comm. E. Bartholomew.

III. Teleutosori amphigenous, orbicular, .5–1 mm. in diam. often crowded and subconfluent, becoming nearly black, surrounded by the ruptured cuticle: heads hemispherical, the larger ones flattened above, 45–85 μ in diam., circumferential spores 12–20 in number, 4–8 in a cross section, polygonal from mutual pressure, 12–15 μ broad: cystoid cells globose or ovate, hyaline or nearly so, 12–15 μ in diameter: stipe of 4–6 conglutinated threads, hyaline or slightly colored, short (25–30 μ), deciduous.

Differs from *R. cassiaecola* Atks. in its smaller, more numerous spores and shorter deciduous stipe.

PHOMA FUMOSA E. & E.

On dead limbs of *Negundo aceroides*, Fort Collins, Colo., March, 1898 (Prof. C. S. Crandall, no. 314).

Perithecia gregarious, on bleached areas of the limbs, punctiform, minute, 100–120 μ in diameter, covered by the epidermis, through which they are visible as minute black specks, giving the part of the limb occupied a smoky appearance: sporules ovate-elliptical, 4–5.5 × 2–2.5 μ.

Differs from *P. negundinicola* Thüm. var. *ramicola* E. & E. in its much smaller perithecia and sporules. Var. *infuscans* is found with the normal form and differs only in being accompanied with a subepidermal *Macrosporium* and toruloid mycelium which blackens the surface of the limb when the bleached epidermis falls off.

ASTEROMA FRASERAE E. & E.

On living leaves of *Frasera thyrsiflora*, mountains around Moscow, Idaho, July, 1897 (Prof. L. F. Henderson, no. 2966).

Spots orbicular, wrinkled, green (about the same color as the leaf), .5–1.5 cm. in diam., becoming brownish: fibrils appressed, brownish-black, radiating and branching: perithecia about 75 μ in diam., seated on the fibrils, pierced above: sporules?

FUSICOCCUM NERVICOLUM E. & E.

On old fallen leaves of *Magnolia Fraseri*, Nuttallburg, W. Va., May, 1898 (L. W. Nuttall, no. 940).

Stromata mostly on the midrib and nerves of the leaf, elliptical, 400–600 μ long, subcutaneous, black, convex, the subconoid apex erumpent: sporules narrow-elliptical, hyaline, subacute, 2-nucleate, 7–10 × 2.5–3 μ.

SPHAEROPSIS ACERINA E. & Barthol.

On dead limbs of *Acer dasycarpum*, Topeka, Kansas, Jan., 1898 (Bartholomew, no. 2445).

Perithecia numerous, 400–500 μ in diameter, buried in the inner bark, often lying close together but not connate, raising the epidermis into strong pustules soon ruptured at the apex: sporules oblong, brown, 19–22 × 6–8 μ.

This can hardly be referred to *S. Clintonii* Pk. or *S. albescens* E. & E. which has smaller perithecia. *S. minuta* Bel. & F. is a foliicolous species.

SPHAEROPSIS SPHAERELLOIDES E. & E.

On dead stems of *Rumex*, Oberlin, Ohio, March, 1898 (H. L. Jones, no. 16).

Perithecia punctiform, minute, (.12–.14 mm. in diameter), scattered rather thickly over the stems, raising the epidermis into minute pustules: sporules elliptical or oblong-elliptical, brown, 12–18 × 8–10 μ.

DIPLODINA POPULI E. & E.

On dead, decorticated limbs of *Populus angustifolia*, Fort Collins, Colo., April, 1898 (Prof. C. S. Crandall).

Perthecia scattered, semi-erumpent, subglobose (250–300 μ) or elliptical (300–400 μ), with papilliform ostiolum: sporules oblong, or slightly clavate-oblong, faintly uniseptate, hyaline, straight or nearly so, 8–10 × 2–2.5 .

HENDERSONIA DIPLODIOIDES E. & E.

On dead, decorticated limbs of *Populus angustifolia*, Fort Collins, Colo., February, 1898 (Prof. C. S. Crandall).

Perithecia thickly scattered, semi-erumpent, small (150–250 μ), ovate-globose, with a small papilliform ostiolum: sporules abundant, smoky-brown, subhyaline, oblong-elliptical, 1–3- (mostly 1-) septate, not constricted, 6–9 × 3–3.5 μ.

The perithecia are often elliptical (on a horizontal section) and more or less depressed.

DIDYMOCHAETA gen. nov. Sacc. & Ell.

(Sphaeropsidaceae, Sphaeroideae.)

Perithecia erumpent, subsuperficial, globose-conoid, membrano-carbonaceous, black, pilose or setose; sporules oblong-cylindrical, uniseptate, hyaline.

The genus exactly corresponds to *Pyrenochaeta*, *Chaetomella* and *Chaetodiplodia*, among the Hyalodidymae.

DIDYMOCHAETA AMERICANA Sacc. & Ell.

Perithecia gregarious, erumpent, globose or obtusely conoid, black, .25–.35 mm. in diameter, sparingly clothed with rather short, septate, brown bristles: sporules cylindric-oblong, straight, rounded at the ends, uniseptate, and mostly broadly constricted or narrowed in the middle, hyaline, 8–15 × 3–4 μ, exceptionally 15–20 × 5–6 μ: basidia inconspicuous, very short.

On dead stems of *Frasera speciosa*, Colorado (Bethel, no. 441).

SEPTORIA ADENOCAULI E. & E.

On leaves of *Adenocaulon bicolor*, mountains around Moscow, Idaho, July, 1897 (Prof. L. F. Henderson, no. 2961).

Spots nearly black, whitening somewhat in the center, definite, partly bounded by the veinlets, 2–3 mm. in diameter, obscured below by the tomentum : perithecia innate, epiphyllous, punctiform, not conspicuous : sporules acicular, slightly curved, continuous, 20–27 × .5–.75 μ.

SEPTORIA CALAMAGROSTIDIS E. & E.

On leaves of *Calamagrostis Canadensis*, Pelican Lake, Wis., June, 1897 (Dr. J. J. Davis, no. 977).

Spots elongated, 2–4 × .5–1 mm., whitening out, often confluent for 3–5 cm., leaf turning yellow around them : perithecia innate, epiphyllous, elliptical, 80–120 × 75–80 μ : sporules arcuate, hyaline, continuous, 12–15 × 1.5 μ.

Differs from *S. epigeios* Thüm. in its much shorter sporules, but closely allied to *S. gracilis* Pass. which, however, is said to have the spots fuscous and sporules straight or scarcely arcuate, 10–12 × 0.7 μ.

CORNULARIA URTICAE E. & E.

On dead stems of *Urtica gracilis* near Ottawa, Canada, Oct., 1897 (Dr. John Macoun, no. 405).

Perithecia capitate, scattered, .5–.75 mm. high ; stem stout, brown, head subglobose or subelongate, flesh color, about 400 μ in diameter : sporules cylindrical, hyaline, 3-septate, 12–15 × 3 μ.

CRYPTOSPORIUM PRUNICOLUM E. & E.

On dead limbs of *Prunus* (*serotina*?) Oberlin, Ohio, March, 1898 (Prof. H. L. Jones, no. 32).

Acervuli subcutaneous, pallid within, 1 mm. in diameter, erumpent through transverse cracks in the bark in tuberculiform masses light-colored at first, becoming grayish-black : conidia falcate-fusiform, multinucleate, hyaline, 45–55 × 2.5–3 μ.

Comes near *C. oxyspermum* Schulz. & Sacc.

CORYNEUM ABIETINUM E. & E. Proc. Acad. Nat. Sci. Phil. 1894 : 375. 1894.

Well developed specimens of this species on small limbs and twigs of dead spruce, sent by Rev. A. C. Waghorne during the winter and spring of 1898, enable us to supplement and improve the description published in 1894.

Acervuli erumpent through an orbicular or elliptical grayish disk 1–1.5 mm. in diameter; conidia oblong, straight, constantly 5-septate, scarcely constricted, 35–40 × 7–8 μ, terminal cells conical, hyaline, intermediate cells olive-brown; pedicels simple or branched, hyaline, sometimes 3–4-septate, 70–80 × 1–1.5 μ.

The difference in the size of the acervuli and conidia would indicate that this is distinct from the 1894 specimens, but a comparison shows that both doubtless represent the same species. The original specimens do not show the orbicular gray disk, which may be due to their being on the thick bark of larger limbs.

BOTRYTIS GLAUCA E. & E.

On bark of *Quercus macrocarpa*, Ottawa, Canada, Oct., 1897 (Macoun, no. 437).

Forming small (2–3 mm.) subdiscoid glaucous-gray patches, soon irregularly and interruptedly confluent: hyphae slender, continuous, 150–250 × 2–2.5 μ, brown (under the microscope), with short, straight, spreading, verticillate branches at intervals bearing the clustered, elliptical, hyaline, 2.5–3 × 1.25–1.5 μ conidia.

Has the habit and aspect of *Menispora glauca*.

ISARIA CAPITATA E. & E.

On dead limbs of *Platanus occidentalis*, near Emma, Mo., Oct., 1897 (Rev. C. H. Demetrio).

Cespitose, cinereous, stems joined at the base, spreading, 1 mm. high, formed of parallel fibers branching above and bearing at their ends solitary globose hyaline conidia 3 μ in diameter forming a subglobose ash-gray head .35 mm. in diameter.

The general appearance reminds one at a casual glance of some *Nectria* or *Cucurbitaria*, the crowded heads simulating perithecia. When crushed, the substance is of a dirty yellow color.

CERCOSPORA HETEROSPORA E. & E.

On leaves of *Euphorbia corollata*, Racine, Wis., July, 1897 (Dr. J. J. Davis, no. 976).

Spots irregular, bounded by the veinlets, 2–5 mm. in diameter, greenish at first, becoming rusty brown and often zonate: tufts mostly hypophyllous, erumpent, nearly white, finally subeffused;

fertile hyphae cespitose, short, continuous, brownish, acute at the apex, 12–20 × 3–4 μ, entire or sparingly toothed above, exceptionally with 2–3 short subdigitate branches above: conidia normally cylindrical, curved, hyaline, 1–5- (mostly 3–4-) septate, 40–60 × 2.5–3 μ, others shorter and thicker, 20–40 × 3–4 μ, nearly straight, narrow at one end.

Distinct from *C. Euphorbiae* Pat. and from *C. Euphorbiae* Kell. & Swingle.

NOTES AND CORRECTIONS.

Fomes alboluteus E. & E. Proc. Acad. Nat. Sci. Phil. **1895**: 413. 1895.

Additional specimens and notes of this species show that it is a *Polyporus* and not a *Fomes*. In the fresh growing state it is very juicy and absorbs moisture to a remarkable degree so that water may be squeezed out of it as from a sponge. Some specimens were 3–4 cm. thick. When mature the pores are prolonged on one side so as to resemble the teeth of an *Irpex*. The spores are oblong, hyaline, 8–12 × 3 μ. Allied to *Polyporus leucospongia* Cke. & Hark.

Amphisphaeria melantera E. & E., Bull. Torr. Bot. Club, **24**: 278. 1897.

The perithecia are quite variable, often depressed and sometimes distinctly collapsed and are smaller than at first stated, averaging about 400 μ in diam.

Lophidium confertum E. & E. Proc. Acad. Nat. Sci. Phil. **1894**: 335. 1894.

Fully matured specimens of this species on dead ash limbs, sent from Oberlin, Ohio, by Prof. H. L. Jones, show that the sporidia finally became 5-septate. In the Ohio specimens the sporidia are larger, 15–22 × 10–12 μ. The perithecia are white inside both in the Kansas and in the Ohio specimens.

This is closely allied to *L. Cotini* H. Fabre.

Montagnella tumefaciens (E. & H.), North Am. Pyren. 253.

Prof. Bethel finds this near Denver, Colo., on dead stems of *Bigelovia graveolens*. The limbs are swollen as in the original specimens and the fungus differs only in its shorter (75–85 μ) asci, and rather smaller (15–20 × 3.5–5.5 μ) sporidia. Var. *reducta*, on limbs of the same host, differs in its 3–6-septate sporidia.

Physalospora Corni E. & E. Proc. Acad. Nat. Sci. Phil. **1895**: 421. 1895.

This is hardly distinct from *P. Corni* Sacc. though the sporidia are longer (20–26 μ). Specimens since sent by Dr. Macoun from the vicinity of Ottawa, Canada, have sporidia also broader (6–8 μ) and asci obscurely paraphysate.

Pleospora juncicola E. & E. Proc. Acad. Nat. Sci. Phil. **1895**: 422. 1895.

Specimens of this species collected by Prof. C. F. Baker at Cameron Pass, Colo., have asci 100–150 × 30–40 μ, sporidia 40–50 × 20–22 μ.

Astrodochium Coloradense E. &. E. Am. Nat. **21**: 430. 1897.

The host of this species is *Populus angustifolia*, not *Quercus*, as stated.

Patinella macrospora E. & E. Proc. Acad. Nat. Sci. Phil. **1894**: 354. 1894.

Change specific name to *monticola*. There is already a *P. macrospora* Massee, which, however, is different from the Colorado species.

A new Species of Utricularia.

By John Hendley Barnhart.

Utricularia macrorhyncha.

Stems white, fibrillous, rooting, utriculate: leaves few, capillary, 2–20 mm. long; scape one (rarely two arising from the same point), slender, smooth, light green, 5–10 cm. high, with several minute scales: flowers 1–3, usually 2; pedicels 6–18 mm. long, ascending in flower, erect in fruit: sepals ovate, 2 mm. long: corolla yellow; upper lip concave, obscurely 3-lobed, 6 mm. long, 10 mm. wide; lower lip concave (or with lateral margins slightly reflexed in age), entire or with merely undulate margin, 8 mm. long, 8 mm. wide, with a prominent orange somewhat 2-lobed palate closing the throat; spur slenderly conical, ascending, closely appressed against the under surface of the lower lip, which it exceeds in length (length 1 cm. or more), obtuse or emarginate at the apex: fruit (immature) spherical.

In mud, or rooting in water not over 5 cm. deep, in springy places near the margin of a small lake, called by the northern settlers in the neighborhood Mirror Lake, but better known among the natives of the region as Calf Lake, Jessamine, Pasco County, Florida, March 26 to April 11, 1898; distributed by me under no. 2537.

In habit, in stems and in leaves, this species resembles *U. subulata* L., with which it grows, but here the resemblance ceases, for the flowers are entirely different, and the scapes of *U. macrorhyncha* are light green and merely slender, while those of *U. subulata* are bronze-colored and capillary.

The flower of *U. macrorhyncha* agrees exactly with that of *U. longirostris* Le Conte as described by Elliott* and by himself,† and as illustrated (though the figure is badly drawn) in connection with the latter paper;‡ but that species was a floating one, while *U. macrorhyncha* roots firmly in the mud, although growing in situations favorable for a floating species. *U. longirostris*, too, is said to flower in June, while *U. macrorhyncha* flowers very early in the spring, and may (probably does) flower again late in the season.

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* Ell. Bot. S. C. & Ga. 1 : 21. 1816.

† Ann. Lyc. N. Y. 1 : 76. 1824.

‡ Ann. Lyc. N. Y. 1 : *pl. 6, f. 7.* 1824.

Several specimens are in herbaria, secured by former collectors, which are probably referable to this species, but they are nearly all in poor condition for determination. I would refer here specimens collected by Wm. M. Canby at Palatka, Fla., in April, 1869, and distributed by him (with a printed label) under the name *U. biflora* Lam. Also a sheet in the U. S. National Herbarium, under *U. subulata*, collected by H. W. R.[avenel], at Aiken, S. C., Sept., 1869. Besides these there are two sheets in the Torrey Herbarium, labeled by Dr. Chapman, "*U. fibrosa*—a rooting form. Springy places, Apalachicola, Florida," and "*U. bipartita* Ell.? Chapm.! Probably a rooting form of *U. fibrosa* Walt. Margins of a pond, Leon Co., Middle Florida." From these specimens it would appear that *U. macrorhyncha* is the same as *U. bipartita* Chapm. Fl. S. States, 283, 1860, not Ell., and *U. fibrosa* Chapm. Fl. S. States, Ed. 3, 301, 1897, not Walt.; but Dr. Chapman's description does not agree exactly with the type of *U. macrorhyncha* in the length of the spur, the height of the scape, nor the size of the flower.

TARRYTOWN, N. Y., June 28, 1898.

Proceedings of the Club.

Wednesday Evening, April 27, 1898.

There were twenty two persons present.

Dr. Underwood presided in the absence of other officers.

Dr. Britton reported the inability of Mr. Clute and Prof. Lloyd to serve longer on the Field Committee. On motion, the Secretary, Mr. W. A. Bastedo, was elected Chairman of that Committee for the remainder of the present year. Mr. Rydberg and Miss Ingersoll were elected associate members of the Committee.

The scientific program followed.

The first paper, by Mr. Tracy E. Hazen, was entitled "Notes on the Life history of *Haematococcus* and other freshwater Algae." He exhibited a dried specimen of *Haematococcus* from Vermont, forming a dull red incrustation on rock, and from which some of his own cultures had been made. The paper, which will soon be published, described the stages of its life history, and was illustrated by colored drawings. Discussion by Prof. Lloyd, Dr. Townsend, Dr. Britton and others followed. The Secretary referred to a gathering of red snow made at the Crimson Cliffs of North Greenland by the Peary party two years ago, which exhibits a more brilliant red than the *Haematococcus* of our own neighborhood. The Secretary arranged to put this Greenland material into Mr. Hazen's hand for comparison. Mr. Hazen's own gatherings here have been made near Fort Lee, in pools.

The second paper, by Mrs. Elizabeth G. Britton, was entitled "An Account of the Mosses collected by Mr. Pierre Jay in Peru and Bolivia in 1893." She exhibited about 60 sheets of these mosses; the specimens shown formed, however, only a small part of the entire collection which includes many species of tropical American genera like *Hookeria* and *Meteorium*, not yet determined. The Bolivian specimens were collected in June and July near La Paz and Yungas and are largely species of high altitudes and exposed localities. The Peruvian specimens were collected in the vicinity of Cuzco and the tributaries of the Madre de Dios, and are mostly forest species, including showy *Phyllogoniums* and *Porotrichums* and various species of *Entodon* and *Rhizogonium.* The collection promises to be very interesting and will be compared with Dr. Rusby's collections of 1885, and M. Germain's, both of which have recently been enumerated and described by Dr. C. Muller in his Prodromus of the Mosses of Bolivia in the Nuovo Giornale Botanico Italiano for 1897.

TUESDAY EVENING, MAY 10, 1898.

There were fifteen persons present.

President Brown was in the chair.

One new nomination for membership was reported: Miss M. Davidson, 350 West Fifty-first street, nominated by Mr. W. A. Bastedo.

Four new members were elected: Miss Harriet B. Bailey, 78 West 105th street; Mrs. A. B. Tweedy, 353 West Boulevard; Mr. Joseph H. Wade, Principal Grammar School 23, Mulberry and Bayard streets, and Dr. John B. Conroy, Public School 39, 235 East 125th street.

The first paper, by Dr. Arthur Hollick and Mrs. Elizabeth G. Britton, was entitled "A Description of a new Fossil Moss from the State of Washington, collected by Prof. I. C. Russell." The paper was read by Dr. Hollick, who also exhibited the original specimen, one sent to Mrs. Britton for identification by Prof. F. H. Knowlton of the National Museum in Washington. Prof. Knowlton supplied the following facts: "The specimen was collected by Prof. I. C. Russell in July, 1897, near Cle Elum, Kittitass, county, Washington, and occurs in the Roslyn sandstone; its age is probably lower Miocene or upper Eocene. It is associated with species of *Lygodium*, *Ulmus*, *Planera*, and a number of other beautifully preserved leaves. It is in any case the oldest undoubted moss thus far found in this country. The so-called *Hypnum Haydeni* of Lesquereux is with little doubt a *Lycopodium.*" The specimen represents only the tip of a branch, about one-half inch in length; it is sterile and has been compared with figures and descriptions of other fossil American mosses, and differs from them all. It is undoubtedly a new species of the Hypnaceae, probably a *Rhynchostegium*, and will be named for its discoverer, Prof. Knowlton.

In the discussion following, it was remarked by Dr. Hollick that fossil mosses are extremely rare. All specimens known are Tertiary or later, one reported from a Carboniferous horizon being now thought doubtful ; but the existence of mosses in Jurassic times is inferred from the existence of an insect then, the present representatives of which feed upon mosses. The only fossil moss heretofore recorded from the United States is Lesquereux's *Hypnum Haydeni*, now believed to be instead a species of *Lycopodium*. Fragments from the Pleistocene have been reported from Canada. The species described this evening is probably the first distinct American species. Thirty or more foreign fossil musci have been described, many of them members of the genera *Hypnum*, *Harpidium*, and *Sphagnum*. To this genus *Sphagnum* belongs the only fossil moss as yet known "in fruit," a Tertiary specimen preserved in brown iron ore.

Discussion followed regarding the reasons for the rarity of moss fossils, Dr. Underwood, Dr. Britton, Mrs. Britton, Dr. Hollick, and the Secretary participating.

The second paper, by Dr. L. M. Underwood, was entitled, "The Species of *Botrychium* of the *B. ternatum* group." The paper, which will soon be published, was accompanied by numerous specimens and followed by discussion at length of the principal eastern representatives, especially of *B. intermedium*.

Mrs. Britton followed with remarks on the Muhlenberg collection of mosses recently transferred from the Philosophical Society of Philadelphia to the Philadelphia Academy of Sciences. They are preserved exactly as Muhlenberg left them, even to the replacing of a knothole. With each specimen is preserved the number he had originally given it, the number he had used in sending it to Hedwig, and the name given it by Hedwig. The bulk of Muhlenberg's ferns went to Willdenow at Berlin.

Among the collections at the Academy of Sciences in Philadelphia, besides those of Schweinitz, Sullivant, Nuttall and Darlington, is that of Pursh, whose herbarium is still a series of scattered sheets, neither mounted nor classified, but with labels supplied in his own hand.

Dr. Britton announced the recent purchase by the New York Botanic Garden of the herbarium and botanical collections of Prof. Lewis R. Gibbs, of Charleston, S. C., through his daughter, Miss Maria R. Gibbs. The herbarium of Elliott is in bad preservation, and much of it gone entirely. The Gibbs herbarium is deemed of special value as illustrative of Elliott's plants.

WEDNESDAY EVENING, MAY 25, 1898.

There were 38 persons present.

President Brown was in the chair.

The minutes were read and approved.

Mr. Bastedo called attention to the forthcoming three-days' excursion to Pt. Pleasant, N. J., in connection with the Philadelphia Academy of Sciences.

The evening was devoted to discussion and exhibition of acaulescent purple violets, introduced by a paper on "The Acaulescent Violets" by Mr. C. L. Pollard, of Washington, D. C., read by Dr. Hollick. This paper, soon to be printed, was the result of field study of the last two years, mainly in the Middle States, from which states most of our original species-types were derived. Mr. Pollard now describes 18 species and 3 varieties. He remarked that for violet characters we must depend upon unremitting field work. Herbarium material is useless except as fortified by previous familiarity with the appearance while growing. Large numbers of individuals must be studied and every feature of the environment must be noted. Careful attention must be given not only to habit but to habitat, to texture of herbage, color of the flowers, to position of the cleistogenes, to nervation, to shape and pubescence of leaves, and to the nature of the surrounding vegetation.

A series of mounted specimens illustrating this paper was exhibited by Dr. Britton, and a large number of fresh specimens were passed, the result of collections sent in by Miss Sanial and by Messrs. Rusby and Crawford, and by Drs. Rusby and Hulst.

The Club was adjourned to the second Tuesday in October.

EDWARD S. BURGESS, *Secretary.*

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Stony Cr.
DAUPHIN
MARYSVILLE
350
SUSQUEHANNA
Conedoguinet
317
HARRISBURG
BRIDGEPORT
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Swatara
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MIDDLETOWN
Conewago Cr.
GOLDSBOROUGH
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MEMBERS OF THE CLUB will please remit their annual dues for 1898, now payable to Mr. Maturin L. Delafield, Jr., Treasurer, 56 Liberty St., New York City.

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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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American Ferns—I: The ternate Species of Botrychium.

BY LUCIEN MARCUS UNDERWOOD.

The species now included in the genus *Botrychium* represent a clearly marked group of plants which are in many cases quite closely allied, a fact that has led to a considerable difference of opinion regarding the limits of the species. Two groups of the genus are made up of species that in their extreme forms approach each other, but still maintain certain characteristics of their own. So close is this approach that in the case of certain poorly preserved herbarium specimens it is difficult or sometimes almost impossible to distinguish the species, which in their living forms or even in well-preserved material are not to be confused. Of these two groups, one is composed of the species *B. Lunaria*, *B. boreale*, *B. lanceolatum* and *B. matricariaefolium*, which in America present a few peculiar modifications which are not, perhaps, of specific importance. The second group, known as the "*ternata*" group, is made up of the diminutive *B. simplex* in which two or more species have been confused, and the series of widely distributed but well-marked species that were confused with *B. ternatum* of Japan by Milde who has been followed more or less implicitly by English and American botanists. While it is evident that in some cases we must depend to a certain extent on habit and foliar cutting rather than on spore characters in order to separate the various species, in the great number of cases there are supplementary characters that will aid in their recognition. It is, of course, possible to assume a wide degree of variation in characters and

[Issued 15 October.]

thus reduce the species of the world to a minimum, but it seems the more logical course to recognize as species those groups of forms that are so clearly marked that no one would question them as distinct things, which though related sometimes rather closely, are not mistakable for one another and cannot be considered as variations induced by age, or by climate or environment acting on individuals recently alike. From any evolutionary standpoint we must necessarily consider all related species as originally springing from a common stock; but when characters have become so fixed as to be unmistakable, it is more simple, more convenient and more logical to recognize the groups of individuals bearing them as species.

The two species of *Botrychium* known to Linnaeus were included in his generic aggregate *Osmunda* which appears to us the more ridiculous because it contains plants which are now recognized as belonging to no less than four distinct families, the Ophioglossaceae, the Osmundaceae, the Polypodiaceae, and the Schizaeaceae. As compiled by Linnaeus in his *Species Plantarum* (1753), *Osmunda* contained the following species: *O. zelandica*, *O. Lunaria*, *O. virginiana*, *O. phyllitidis*, *O. hirta*, *O. hirsuta*, *O. adiantifolia*, *O. verticillata*, *O. cervina*, *O. bipinnata*, *O. filiculaefolia*, *O. regalis*, *O. Claytoniana*, *O. cinnamomea*, *O. Struthiopteris*, *O. Spicant* and *O. crispa*, species that are now scattered among the genera *Helminthostachys*, *Botrychium*, *Anemia*, *Acrostichum*, *Onoclea*, *Osmunda*, *Blechnum* and *Cryptogramma*. Other species were added to *Osmunda* by Thunberg, Cavanilles and Lamarck, so that the latter recognized 30 species in his Encyclopédie Methodique of which the volume containing this genus was published in the fourth year of the Republic (1797), and the number was not increased during the closing years of the century. In 1801 Swartz* cut off from this group three of the Linnaean species *O. Lunaria*, *O. virginiana* and *O. zeylandica*, which together with *O. ternata* Thunb. and a species of his own making, formed his genus *Botrychium*. He was none too soon for in the same issue of the same journal, Bernhardi, unaware of Swartz' work and evidently not informed by the editor of the duplication, established the genus *Struthiop-*

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* Schrader's Journal für die Botanik 2^1: 110. 1801.

teris for *O. regalis*, and its two allies, and left *O. Lunaria* and *O. virginiana* to stand for the genus *Osmunda*. It will thus be seen that it was a mere accident of priority of place in publication that prevented the species of *Botrychium* from bearing the name *Osmunda*, for mere deference to Swartz who was better known than Bernhardi, evidently led the editor to give precedence to Swartz' paper in the issue of his journal.

In 1806 Swartz,* after placing *O. cervina* in *Acrostichum*, *O. Struthiopteris* in *Onoclea*, *O. Spicant* (with another uncalled-for specific name) under *Blechnum*, and *O. crispa* under *Pteris*, cut off another genus from the Linnaean *Osmunda*, namely *Anemia*,† with seventeen species of which *O. phyllitidis* L. is first named, with *O. hirta*, *O. hirsuta*, *O. adiantifolia*, *O. bipinnata*, *O. verticillata* and *O. filiculaefolia* together with five species of Cavanilles, four of Lamarck and one by Swartz himself.

The varied practice of botanists with regard to fixing the group with which the Linnaean generic name shall hold is well illustrated by this comparatively simple case. It will show the absurdity of using some of the methods employed by modern botanists and serve to point out a line of nomenclatorial investigation that deserves consideration, since there has been neither uniformity in practice nor a definite ruling,‡ but which is more vital to stability than many of the problems that have reached essential uniformity in practice. The various methods hitherto employed for fixing the Linnaean generic name to a group of plants from which successive genera have been taken off are as follows:

1. The generic name must rise or fall with the first species described under the genus. In the case in hand this method would result in fixing the name *Osmunda* for the genus we now know as *Helminthostachys* § since *Osmunda zeylandica* was the first Linnaean species named. This plan is not commonly followed except in the case of genera that were monotypic with Linnaeus,

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*Synopsis Filicum. 1806.

† This name has been variously corrupted in orthography but this is the original form in which it was established.

‡ The Paris Code, Art. 54, leaves this point indefinite.

§ The name *Helminthostachys* was applied to this plant by Kaulfuss, 1824.

when no other course could be logically pursued. In practice, however, as shown below, this principle is not always followed even in the case of monotypic genera and we have in certain cases the anomaly of a Linnaean generic name applied to a group of plants not closely related to the one which was known to Linnaeus or his predecessors, and the Linnaean plant is now known under a totally different generic name.

2. The second method is to allow the original name to hold for that species or group of species which is left of the original Linnaean series after the successive genera have been taken out. This is known as "the method of residues," and is one commonly practiced. Since Swartz first carved *Botrychium* from the original *Osmunda* of Linnaeus, and Bernhardi followed it up by separating the members of the *O. regalis* group under the name *Struthiopteris*, this method applied to the case in hand would require the name *Osmunda* to stand for the group of species we now know under the name of *Anemia*.

3. Another method less frequently employed is to apply the name to the last of the residue left of the original genus as it existed when the first new genus was cut off. This course applied to the case in hand would also result in making the name *Osmunda* stand for the species of *Anemia*, since the additions made to the genus *Osmunda* by Lamarck and Cavanilles all happen to be species of either *Botrychium* or *Anemia*, and the former genus was the first to be separated from the Linnaean *Osmunda*. This plan is one that is sometimes followed far beyond the limits noted above, and the result occasionally happens that a Linnaean name is shifted from group to group of plants until it finally rests with a lot of species with no near relations to the original ones to which the name was first applied, or else as a means of reducing the difficulties in the case, some one suggests the dropping of the original name altogether, as has recently been proposed with the Linnaean *Jungermania* and has before been done with such genera as *Phallus* and *Lichen*.

4. A better course, but one which has been rarely used, especially in these later days, is to determine pre-Linnaean usage and to ascertain the source from which Linnaeus derived his name originally and then apply it to the species or group of species to

which it was first applied. It would seem that this is the only legitimate method to follow. In this particular case it would result in holding the name *Osmunda* for *O. regalis* and its allies to which it was applied by Tournefourt and others long before the compiler, Linnaeus, adopted it for the conglomerate group of plants which he called *Osmunda.* For the genera established after Linnaeus it would seem to be more rational to adopt as the type of the genus the first species mentioned under the genus as originally defined. This, however, raises the question as to what disposition shall be made of those early genera, which were not based on any species but were defined by a brief statement of characters; but it will surely have the effect to pin the regularly established genera down to some definite species so that whatever changes are made, the generic names will have a definite abiding place. We propose to apply this method to the genera of ferns in the discussions to be given in this series of papers on the American species.

For the present we will consider in historical sequence the various species of *Botrychium* of the "*ternata*" group that have been proposed by authors early and recent, and endeavor to supplement, for the American species particularly, the outline of specific limitations so clearly but briefly presented by the only modern investigator who has made an extended study of the group.* This study is based on an examination of the collections at Kew, Berlin and Paris, in addition to all the collections of importance, public and private, that are found in the United States, supplemented by a somewhat extended field examination of the genus as it occurs throughout the eastern half of the American continent. While our knowledge of the various species is by no means complete, the conclusions here reached are based on the widest possible array of attainable data.

1. BOTRYCHIUM TERNATUM (Thunb.) Swz.

The original member of the so-called "*ternata*" group of *Botrychium* was described and figured by Thunberg in his Flora Japonica in 1784. The description reads as follows:

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*Prantl, Jahrb. des kōn. bot. Gartens Berlin, 3: 1884. It is unfortunate that Prantl and other continental monographers could not have had access to a wider array of materials. The Germans have largely neglected to visit Kew and the English pteridologists have just as thoroughly neglected Paris and Berlin.

"Osmunda ternata. O. scapo caulino solitario, fronde tripartita supradecomposita. id. Tab. 32.

"Crescit circum Nagasaki, ubi semel legi.

"Floret Octobri, Nobembri.

"Radix fasciculata fibris numerosis, filiformibus, parum fibrillosis.

"Stipes inferne simplex, pollicaris, mox divisus in duas partes frondem scilicet et scapum floriferum.

"Frons solitaria, petiolata, supradecomposite ternata, glabra. Petiolus frondis compressiusculus, digitalis, inferne triternatus, nudus, superne frondosus, bipinnatus. Pinnae et pinnulae alternae, incisae, tenuissime serratae.

"Scapus e basi petioli frondis, teretiusculus, striatus, erectus, nudus, glaber, fronde duplo longior, apice cernuus, floriferus.

"Florum spica ramosa; Spiculae alternae antheris globosis.

"Conf. O. Virginica, Plum. Filic. p. 136, tab. 159."

The figure that accompanies this description very clearly represents a plant that is common in collections from Nagasaki and vicinity, but by no means includes all the species that have been discovered in Japan and distributed as *Botrychium ternatum*. By some oversight, or seeming lack of space, Thunberg's artist has drawn the figure with only two branches to the sterile segment, but from the description we must interpret this as an error, as pointed out by Kunze * many years ago.

Specimens of genuine *Botrychium ternatum* are to be seen in the Kew Herbarium from Japan, collected by Maximowicz, Oldham (two sheets), Pere Faurie and Maries; from China (Keio Kiang) Dr. Sherer; from India (northwest) collected by Falconer, (Khasya) Griffith, (Sikkim) C. B. Clarke. In Herb. D. C. Eaton is a Japanese specimen from Nagasaki, Oldham, which is curiously enough placed in the cover with Eaton's "Var. *australe*," another instance of a type being interpreted as a variety of itself! In Herb. Gray there are three sheets of true *B. ternatum* from Japan, one collected "Nov. 1889," one collected by Maximowicz, and one by Oldham, the last also mounted with a sterile leaf of the species mentioned below as *B. Japonicum* (Prantl). In the Herb. Mus. Paris, there is one specimen from India (Voy. Jacquiminot); four from Japan (Oldham; Savatier, n. 1611; and two "ex Franchet"); and two from China (M. Simon n. 16, and Perny). In the Berlin collection are some sixteen sheets from Japan, most of them typical, but a few somewhat smaller as are also some in our own collection from near Tokyo, communicated by Dr. Matsumura. In the Herb. California Academy of Science there is a single sheet of this species. These include all the genuine *B. ternatum* I have seen, and they represent a well defined species totally different from the many forms that have been referred to it by subsequent writers. No one, who holds any modern view of species, who has seen genuine specimens of *B. ternatum* from Japan, could hold for a minute that it was the same as the various species that occur in North America, and would adopt at once Prantl's masterly definition of this thin-leaved species with such a natural geographic range.

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* Bot. Zeit. **6**: 491. 1848.

2. BOTRYCHIUM MATRICARIAE (Schrank) Spreng. Syst. Veg. **4**: 23. 1827.

Osmunda matricariae Schrank, Baier. Fl. **2**: 419. 1789.
Botrychium rutaceum Swz. Schrader's Journ. **2**: 111. 1801.
Botrychium matricarioides Willd. Sp. Pl. **5**: 62. 1810.
Botrychium rutaefolium A. Br.; Döll. Rhin. Fl. 24. 1843.

This appears to be the second member of the group described and it will be seen that it has been abundantly supplied with names, each one of which has been used in reputable monographs. We are indebted to Ascherson * for the elucidation of the synonymy. The species was described from Central Europe where it appears to have a somewhat widespread distribution. Numerous sheets of this species from Europe occur in the European herbaria and nearly all of the larger American collections possess a fairly representative series. There are a few specimens from the Northern United States and Canada which must be referred here; among these I would particularly mention a plant in our own herbarium collected by Mr. Pringle in "Old meadows, Vermont, September 26, 1878," which agrees perfectly with the figures represented by Luerssen,† in fact more closely than any of the European specimens in our collection. A number of small specimens erroneously distributed under the name of "*Botrychium ternatum*, sub-var. *intermedium* D. C. Eaton," probably belong here also. The exact relation of this species to larger forms which are not clearly referable to any defined variety or species is not yet accurately made out. Most of these forms are confined to the Northern States and more particularly to New York and New England. These are various in size and this variation is doubtless due in part at least to age, but until we can cultivate the various forms and watch their development for a succession of years we shall probably have no very clearly marked data on which to base conclusions in regard to specific relationships. Botanical collectors to whom these northern forms are accessible can render an excellent service by watching the development of young plants through a succession of years, and that of different individuals under various environments.

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* Syn. Mitteleurop. Fl. **1**: 109. 1896.

† Rabenhorst's Krypt. Fl. **3**: 584. *f. 182.*

3. BOTRYCHIUM BITERNATUM (Lam.) Underw. Bot. Gaz. **22**: 407. 1896.

The third fern of the "*ternata*" group to be described was the above species, which has also been singularly unfortunate in having too many names. After its original name of *Osmunda biternata* given it by Lamarck in 1797, it was next independently described in the genus *Botrypus* of Richard* as *Botrypus lunarioides*, which led Swartz a little later to transfer it to his earlier genus as *B. lunarioides*. Then Willdenow† described it anew as *B. fumarioides*, quoting both the prior names and citations, and Sprengel‡ seventeen years later, apparently dissatisfied with the work of his predecessors, after quoting all three of the preceding names, proceeds to baptize it anew as *B. fumariae* Sprengel! Surely the age of irruption in nomenclature is a thing of the past instead of the present. In thirty years this plant had three generic and four specific names and with the exception of Richard each successive author quoted all the names given by his predecessors!

The reasons for maintaining this species as distinct we have already given in the Botanical Gazette,§ and after having seen the type specimens at Paris and various supplementary specimens in numerous herbaria we are more than ever convinced that this species is absolutely distinct from its congeners and can be recognized more clearly than any of the other species of this group by its unique biological characters as well as by its distinct form.

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* Michx. Fl. Bor. Am. **2**: 274. 1803.

† Sp. Pl. **5**: 63. 1810.

‡ Syst. Veg. **4**: 23. 1827.

§ Bot. Gaz. **22**: 407. 1896; **23**: 464. 1897.

The specimen in the Michaux herbarium at Paris is badly folded, overlapping itself in such a way as to obscure some of its characters, yet it is clearly the same plant that we have seen growing in the South and that was figured in our Gazette article. The specimen bears no data as to time of collection except the brief record "in pascuis sabulosis juxta Charleston." In the general Paris Herbarium there are three other specimens, one of which bears no data except "Am. Sept."; the second "Caroline par Bosc an XI," and the third "des environs de Charlestown par Richard de l'herbier de Michaux 1808," all of which are the exact form which we have figured as stated above.

Additional specimens have been seen as follows:

Kew Herbarium: South Carolina, Charleston, Elliott (a torn and fragmentary specimen); Louisiana, New Orleans, Drummond, the latter differing only in slightly longer segments.

Berlin Herbarium: One specimen, typical, marked "*B. fumarioides* ex herb. Willd. 1806–12," without locality; and one Alabama specimen (Mohr, "Ex Herb. Mettenius"). In Willdenow's herbarium is a single specimen sent by Richard, so that the *B. fumarioides* Willdenow is exactly the *Botrypus lunarioides* Richard.

Gray Herbarium: Georgia, Burke county; Florida, Chapman; neither with dates of collection.

D. C. Eaton's Herbarium: South Carolina, L. R. Gibbs, 1846; Alabama, Mohr, April (plants dead ripe).

Davenport Herbarium: Alabama, Mohr, March, 1879 (4 plants); South Carolina? fragmental specimen marked "B. & M." ex herb. Phila. Acad.

Philadelphia Acad. Nat. Sci. Herbarium: One sheet with five plants, no locality given, marked "B. & M."

Walter Deane's Herbarium: South Carolina, Columbia, K. A. Taylor, May, 1890 (plants dead ripe); Alabama, Mohr (ex herb. Davenport).

Columbia University Herbarium: South Carolina, "St. John's F. P. Porcher, M.D.;" Charleston, "Comm. Dr. L. De Witte, 1838."

Canby Herbarium (N. Y. Coll. Pharmacy): A single specimen communicated by Lapham, marked "Lake Superior?" and penciled by D. C. Eaton as undoubtedly an error, which is surely the case.

These with the specimens collected by myself in Alabama and those previously quoted from the collection of Dr. Mohr, of Mobile, constitute all the available material that we can find in any public herbaria of this apparently widely distributed but rarely collected species. The habit of this plant growing on open grassy knolls where even botanists would scarcely look closely for plants in early spring, together with the fact that its short stem and sessile leaves causes it to be a very inconspicuous object, would account for its rarity in collections, had we not the added difficulty of the scarcity of competent field botanists in the Southern States. It is hoped that this second calling attention to the plant will result in a more extensive knowledge of its habits from future discoveries. It will be seen that there is not a particle of evidence to show that its period of maturing spores is due to anything in the climate, for *B. obliquum* its nearest ally is found in the very same regions, and like its northern congener matures late in the autumn. In the light of all the material that we have been able to examine, our friend Davenport's attempts to subdue the species* and to connect its unique period of maturity with straggling specimens from farther north appear more and more like a strained effort.

The petiole of the sterile segment while usually wanting is occasionally a centimeter long but it normally maintains its sessile character and the cutting of the segments is remarkably constant. When we include its biological characters and its unique period of spore maturity, we find it the most distinct of any of the species of this group, an opinion concurred in by all other botanists who have seen the plant in a living condition.

4. BOTRYCHIUM DISSECTUM Sprengel, Anleitung zur Kenntniss der Gewächse, **3**: 172. 1804.

This species is the fourth of the series that was recognized. Sprengel described it in these words:

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*Bot. Gaz. **23**: 282–287. 1897; Fern Bull. **5**: 40–43. 1897.

> "Eine neue Art habe ich aus Virginien erhalten, die ich *Botrychium dissectum* nenne. Der Wedel ist dreyfach getheilt und fast dreyfach gefiedert; die Blättchen der zweyten Ordnung sind lanzetförmig, stumpf und theilen sich in Keilförmige, stumpf gekerbte oder eingeschnittene Läppchen. Die Fruchtähre ist fast dreyfach gefiedert. Mit dem *Botrychium Virginicum* kommt diese Art einiger Massen überein, nur dass bey jenem die Blättchen der zweyten Ordnung spitzig zulaufen und in spitzig eingeschittene Läppchen getheilt sind. Michaux hat (Flor. boreali-americ. vol. II., p. 274), einen *Botrypus lunarioides* der mir dieser neuen Art in der dreyfachen Eintheilung des Wedels und der Aehre uberein kommt, aber er unterscheidet sich durch die rundliche Nierenform der Blättchen."

Considering the time in which this was written, the description is fairly good, and it indicates very clearly a species that is found very common in the vicinity of New York city, and thence southward, extending in the interior to Ohio, southern Indiana, and Kentucky. It is also found in various New England states, having been collected as far northeast as Essex county, Massachusetts, by Mr. John Robinson, but the typical form does not appear to be as common in New England as farther southward, particularly inland from the Atlantic coast. The species was well known to Willdenow, Pursh, Mühlenberg, Greville and Hooker, and by them properly recognized as a good species. It was fairly well figured by Schkuhr in 1809,[*] and less perfectly by D. C. Eaton in 1879,[†] the latter from a young or imperfectly developed specimen. Willdenow's herbarium contains a single rootless plant of this species sent by Mühlenberg, which is exactly typical of the species as known from New York southward.

This species reaches its fullest development in moist shady woods; a specimen in my collection from Whiteplains, New York, having a sterile lamina 22 cm. wide by 14 cm. high. The primary and secondary pinnae are cut down to a narrowly winged rachis scarcely more than a millimeter wide, and the pinnately arranged segments emerge alternately from this rachis by a lamina perhaps 2 millimeters wide, breaking up somewhat palmately into narrow tooth-like divisions which fork repeatedly and end normally in two divergent teeth. The stem is usually very short (2–2.5 cm.), the petiole of the sterile lamina is 7.5 cm. or less, the petiole of the sporophyll is 24 cm. or less long.

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[*] Kryptog. Gewächse. *pl. 158.*

[†] Ferns of North America, **1**: *pl. 20. f. 1.*

In mossy meadows in New England and Central New York, where exposed to the direct rays of the sun, the plant takes on a more contracted habit, the segments are much shortened and the plant approaches somewhat the form of segment seen in *B. obliquum* which often grows with it. But even under these circumstances the plants are unmistakable, and while they approach more nearly than at any other point, they do not blend one with the other, while in their normal development they are widely separated. In the New England plant growing in the above situations the petiole of the sterile lamina is much reduced and the lamina itself is usually much smaller than in fully developed forms of the species.

5. BOTRYCHIUM AUSTRALE R. Br. Prod. Fl. Nov. Holl. **1**: 164. 1810.

Of the two species described during the year 1810, this appears to be the first that was made known and was described as follows:

> "B. australe, scapo subradicali, fronde ternata, foliolis bipinnatis, pinnulis confluentibus incisis. (J. D.) v. v. Port Jackson, Van Dieman's Land."

This brief description is utterly unsatisfactory, and, were it not for Robert Brown's plant at the Kew Herbarium together with several other plants from the type locality or from other portions of the Australian region, we might very easily unite this species with almost any of the others. With Brown's plant in existence it is hard to understand some of the later comments on the species. Greville and Hooker, in their Enumeratio Filicum,* say: "This comes very near to the preceding [*B. Virginicum*] in the size, habit, and other characters." J. D. Hooker in 1867 † refers this species to *B. cicutarium* Swz., a species as large as *B. Virginianum* which Plumier figured from San Domingo, but which so far as we know has not been rediscovered. D. C. Eaton likewise makes this the nominal basis of the var. *australe* of his composite species which includes the very large Californian plant which we shall refer to below under *B. silaifolium* Presl.

The plants of this species are comparatively small, the sterile

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* Bot. Miscellany, **3**: 223. 1833.

† Handbook New Zeal. Fl. 387. 1867; *cf.* also Fl. Tasman. **2**: *pl. 169b.*

lamina of Brown's type being only 8 cm. wide by 6 cm. high; the others are somewhat larger, especially a specimen in the Kew Herbarium from New Zealand which measures 17 by 12 cm. The plants are fleshy and in texture approach some of the American species of the group more nearly than the Japanese *B. ternatum*; the segments, however, are very different and the characters are sufficient to keep the species distinct. There are nine sheets of this species in the Kew Herbarium with a distribution from Australia to Tasmania and New Zealand. A second New Zealand species will be noted below under *B. biforme* Colenso.

6. BOTRYCHIUM OBLIQUUM Mühl.; Willd. Sp. Pl. **5**: 63. 1810.

This species, the most common in the eastern portion of America, was sent by Mühlenberg, under the above name, to Willdenow who published it as follows:

> "B. scapo inferne unifrondoso, fronde subbiternato, foliolis oblongo-lanceolatis serrulatis basi inaequaliter cordatis. W.
>
> "Botrychium obliquum. *Mühlenberg in litt.*
>
> "Schiefe Mondraute. W.
>
> "Habitat in Pennsylvania. (v. s.)
>
> "Scapus quinquepollicaris basin versus unifrondosus. Frons irregulariter biternata. Foliola semipollicaria oblongo-lanceolata serrulata basi dilatata cordata valde inaequalia. Spicae bipinnatae. W."

Seventeen years later Sprengel, whose knowledge of the American species was based on very insufficient data, after redescribing *B. fumariae* (*B. biternatum*) added "*B. obliquum* Mühlenb. W. est junior planta" —a statement the more remarkable when we know the relative size of the two species! The type of this species is in Willdenow's herbarium at Berlin and consists of a small rootless specimen of the familiar eastern plant with the sterile lamina only 5.5 × 4 cm.; larger specimens from Mühlenberg also exist in the Kew Herbarium so that there is no doubt of the type of the species. It has the widest range of any of our species extending from Canada to Mexico, but is rare west of the Mississippi River. A thin leaved southern form which ranges from Florida to Texas may be worthy of varietal rank at least. The exact relations of Eaton's "sub-var. *intermedium*" to this species are also difficult to discover and will possibly involve cultivation to elucidate relationship; much doubtless depends on age and environment.

7. BOTRYCHIUM SILAIFOLIUM Presl, Rel. Haenk. **1**: 76. 1830.

B. ternatum, var. *australe*, D. C. Eaton, Ferns N. Am. **1**: *pl. 20a.* 1879 (in part). Not *B. australe* R. Br.

Presl described this species as follows:

> "B. fronde radicali tripinnata, pinnis primariis secundariisque petiolatis, pinnulis subsessilibus ovatis crenato-dentatis, inferioribus sublobatis, scapo nudo, panicula coarctata. Hab. Nootka-Sund.
>
> "Frons radicalis solitaria ambitu cordato-ovata, tripinnata, petiolo tripollicari rhachibusque sulcato. Pinnae primariae 5-pollicares oppositae petiolatae patentes ovatae obtusae. Pinnae secundariae sesquibipollicares suboppositae petiolatae oblongo-lanceolatae. Pinnulae alternae et suboppositae ovatae obtusae glaberrimae carnulosae virides, inferiores, 5–6 lineas longae subsessiles trilobae, mediae sessiles ovato-lanceolatae bilobae et profunde dentatae, supremae crenato-dentatae. Scapus pedalis sulcatus, fronde aequilongus. Panicula secunda ramosa, ramis suboppositis ramosissimis, inferioribus ultra 3 pollices longis.
>
> "Capsulae luteae magnitudinae seminis Milii. Semina flavo-viridia."

Greville & Hooker in their Enumeratio Filicum * speak of this as "a very distinct species as appears from the description," and this early opinion appears to be the correct one.

Through the kindness of Dr. Victor Schiffner of Prag, we have been able to see the original type from Presl's herbarium and it coincides exactly with the forms that are more or less common in collections from California. Dr. M. A. Howe has collected very fine specimens at Sisson, near Mt. Shasta, in well shaded woods at an altitude of about 3,500 feet. Other plants are in collections from farther south in the Sierras, and there is a specimen at Berlin, collected in the Cascade Mountains, Oregon, by Howell. Dr. Howe's specimens were collected 31 July and are very immature, the old leaf of the preceding season persisting, the young lamina unfolding and the sporangia well-formed but still partly unfolded as is also the case with Presl's plant which is only a little farther advanced. The species has been fairly well figured in outline in Eaton's Ferns of North America as var. *australe* (California form only) but how it could have been possible to confuse this noble species with the much smaller *B. australe* R. Br. from Australia is hard to understand!

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* Bot. Misc. **3**: 224. 1833.

8. BOTRYCHIUM DAUCIFOLIUM Hook. & Grev. Icon. Fil. **2**: *pl. 161.* 1831.

B. subcarnosum Wall. Cat. no. 49. *nomen nudum;* Hook. & Grev. Bot. Misc. **3**: 222. 1833.

This plant appears to be the next species which was definitely made known. In the Kew Collection, in addition to the earlier plants of Wallich, there are abundant recent specimens. The plant is a coarse species with the sterile lamina ranging up to 30 cm. broad and 25 cm. long; the petiole of the sterile lamina is usually short (4–6 cm.); the stem is elongate, often up to 3 dm. The plant is ternate but the two lower divisions are alternate, varying as much as 1–2 cm. in their origin; the texture is thin, the veins being clearly visible and consist in each segment of a main vein pinnately branched and a second smaller supplementary vein rising below the midvein. This feature is very characteristic, appears in very small segments, and is very different from the figures given by Greville (*loc. cit.*) which shows an ordinary pinnate midvein. The segments are set at an angle of about 45° to the rachis and the lower are often lobed on one or both sides. Very large specimens rarely show a second smaller supplementary vein.

The species is represented by fifteen sheets in the Kew Herbarium, besides a specimen from Samoa gummed on a sheet with *B. Japonicum* mentioned below. The distribution includes Nepal, Nilgherries, Sikkim, Ceylon, Birmah, Society Islands, Samoa. A single specimen from Java has more acuminate segments, lacks the supplementary vein and deserves further study.

B. subcarnosum differs mainly in its smaller size, shorter petiole to the sterile lamina, and more simple panicle; it can hardly be maintained as distinct.

9. BOTRYCHIUM DECOMPOSITUM Martens & Galeotti, Mem. Acad. Sci. Bruxelles **15**:—(15). *pl. 1.* 1842.

Although D. C. Eaton referred this also to his all-embracing *B. ternatum* var. *australe*, we shall be obliged to hold it distinct from *B. silaifolium* to which it is allied, for the present at least, until we can know more definitely the limits of the two species, their habits and field characters. Liebmann's plant in Herb. Kew and

Bourgeau's Orizaba plant, no. 3194, in the same collection, are fairly typical forms as figured in the original publication. A sterile plant in the Columbia Herbarium, collected in Orizaba by Müller, is also fairly typical of the species as originally described and figured. Not all the Mexican forms of this group can be referred to the same species. Besides *B. obliquum* there are, at present, indications of at least three distinct species from Mexico, and while these are already represented by specimens in our own collection, detailed information regarding their characters, habits, and distribution is very much desired.

10. BOTRYCHIUM SUBBIFOLIATUM Brack. U. S. Expl. Exped. 317. *pl. 44. f. 2.* 1854.

This very distinct species from the Sandwich Islands which Brackenridge beautifully figured, in spite of its reference to *B. ternatum* by Eaton and to *B. daucifolium* by Baker, must stand as a clearly defined species, its alliance being with *B. daucifolium.* The type is at Washington in the National Herbarium and duplicates of it are at Kew together with two other specimens both imperfect; in the Berlin Herbarium are three fine specimens, two from the Herb. Hillebrand collected by Baldwin and Lydgate, and one collected by Remy; these with a single imperfect specimen in the Paris Herbarium appear to be the only material accessible. The sterile lamina is about 15 by 11 cm., the stem about 7 cm. and the petiole of the sterile lamina about 11 cm. As it appears to have been rarely collected and little is known of its habit, additional material is very much desired, the more so since the Hawaiian Islands have become a part of our own country.

11. BOTRYCHIUM BIFORME Colenso, Trans. New Zeal. Inst. **18**: 223. 1886.

This is surely a distinct species as shown from various specimens in the Kew Herbarium including one collected by G. Bennett 1863,* and a sheet of several specimens from Colenso himself.

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* With the Bennett specimen there is a letter from Mr. Bennett to J. D. Hooker which is endorsed, "In every particular this is *Botrychium dissectum* of North America." The specimen is glued to the same sheet with a specimen marked "*Botrypus dissectus* P., Herb. Pursh propr." and this serves to emphasize the contrast between the two species which even a novice would recognize as distinct.

There is a single specimen in the Columbia Herbarium which is also to be referred here. It is possible that there is an earlier name for the species, but we have not been able to find any. Notwithstanding Mr. Baker's assertion to the contrary † it does not "exactly match the North American *B. dissectum* Muhl." or come anywhere near doing so, and one must have defective vision to think of confusing the two species even though they are both forms with narrow segments.

To the above list of species, all of which, with the single exception of *B. daucifolium*, have been confused with *B. ternatum* at one time or another, we are obliged to add three more:

12. BOTRYCHIUM COULTERI sp. nov.

A stout fleshy plant growing in geyser formations. Roots numerous, fleshy, stout; stem very short, 2–3 cm. long, very stout, 1.5–2 cm. in diameter, swollen with the contained bud of the succeeding season, soon dividing to form the sterile and fertile laminae; petiole of the sterile lamina very short, 2–2.5 cm. long, stout, sulcate in drying; sterile lamina about 15 cm. wide, the central portion about 9 cm. long, this and the lateral ones tripinnate, or quadripinnatifid; segments obliquely ovate, 1 cm. or more long, 0.5 cm. or more wide, thick, fleshy, the margin entire or slightly repand; veins few, scarcely perceptible; petiole of the sporophyll about 17 cm. long including the panicle; panicle quadripinnate below, the pinnae crowded, gradually simpler above; sporangia very numerous, bright yellow; spores copious, pale yellow.

The leaf persists well into the second season, the new stem growing through the base of the old, the marginal portion of which surrounds it like a sheath; the plant is slightly hairy throughout when young; the bud is very large, and somewhat hairy at the margins of the pinnae but not densely pilose like that of *B. obliquum*. The sporophyll is not uncommonly double.

In geyser formations near a stream in open places, Yellowstone National Park, P. A. Rydberg and Ernst A. Bessey, 7 Aug. 1897. Dr. Rydberg and his assistant collected some 150 specimens of this interesting species. It was apparently first collected by Dr. John M. Coulter, at Lower Fire Hole Basin, 1872, as shown by specimens in the collections of T. C. Porter; we take pleasure in naming it for its original collector. Specimens are in the U. S. National Herbarium collected by J. M. Coulter at Teton Lake (Hayden's Expedition), Yellowstone Park, Tweedy, 1885, and small young specimens in grassy meadows near Moscow, Idaho, L. F. Henderson. Specimens are in the Gray herbarium from Shoshone Basin, August 23–26, 7,800 ft. marked, "Grows in all the Geyser Basins, C. R."

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† Annals of Botany, 5: 500. 1891; New Ferns, 117.

Dr. Rydberg who has seen this species in life in abundance says that it differs in habit from the eastern *B. obliquum* as widely as that species differs from *B. Virginianum;* it is very distinct from any of our other species.

14. BOTRYCHIUM OCCIDENTALE sp. nov.

A tall fleshy plant of open woods. Roots fibrous, fleshy; stem short, 2–5 cm. long, 5 mm. or more in diameter; petiole of the sterile lamina 11–12 cm. long, rather slender; lamina very large, 18–20 cm. broad, 13–14 cm. high, the lateral divisions bipinnate with about 5 pairs of mostly opposite pinnae; the terminal division tripinnatifid, gradually simpler above; ultimate segments nearly oval, mostly narrow (under 5 mm. wide), the margins finely but irregularly crenulate; texture fleshy, the veins indistinct; sporophylls 4 dm. long (including the panicle which ranges from 10–15 cm.), tripinnate almost throughout its entire length; bud densely hairy with white silky hairs.

New Westminster, British Columbia, 31 July 1897 and 7 Oct. 1897. A fine series collected by Mr. A. J. Hill are in our herbarium. Specimens collected at Sproat, Columbia River, July 18, 1890 (Macoun), and from the Yakima region, Washington (Brandegee), are in the herbarium of the California Academy of Science, and at both Kew and Berlin are excellent specimens collected by Dr. Lyall, 1858–9, on the Oregon Boundary Commission, latitude 49° N.

15. BOTRYCHIUM JAPONICUM (Prantl).

Botrychium daucifolium β Japonicum Prantl, Jahrb. des kön. bot. Gartens Berlin, **3**: 340. 1884.

A tall forest plant with thin foliage. Stem slender, 7–9 cm. long (in younger plants as short as 3 cm.), often clothed with the scarious base of the stem of the preceding year; petiole of the sterile lamina 9–12 cm. (in younger plants not exceeding 3.5 cm.); sterile lamina 23 cm. or less wide, the central portion 14 cm. or less high, this and the lateral portions twice pinnate; pinnae broadly lanceolate, 3–6 cm. long, thin, the lowest again pinnate, the upper merely pinnatifid, with narrow sinuses; margin everywhere sharply serrulate with teeth 0.5 mm. long, curving upwards; sporophylls 30–35 cm. long including the panicle, slender; panicle tripinnate with rather wide rachises so that the sporangia appear to be turned to one side.

Japan, "In silvis prope urbem Tokyo, frequens," J. Matsumura; Shimogamo, Kyoto, October 1893, "not common," Tasuke Hattori. Plants marked in Professor Prantl's own writing appear in the Berlin herbarium.

This is the Japanese plant that Baker refers to *B. daucifolium* and is the one mentioned as *B. daucifolium* in Franchet and Savatier's Enumeratio* as shown by Franchet's own plants in the Paris herbarium. It is more or less common in collections from Japan and has been indiscriminately taken for *B. ternatum* and *B. daucifolium.* While it has nothing closely in common with the former, it differs from the latter in its more delicate texture, and widely in the cutting of its sterile lamina. It is a very clearly marked species. Its common name in Japan is said to be "hanawarabi."

The ternate species of *Botrychium* as thus outlined have a distribution covering all the continents except Africa; the described species are distributed as follows:

Europe (1): *B. matricariae.*

Asia (3): Japan—*B. ternatum, B. Japonicum;* China—*B. ternatum;* India—*B. daucifolium, B. ternatum.*

Australasia (4): Hawaii—*B. subbifoliatum;* New Zealand—*B. australe, B. biforme;* Australia—*B. australe;* Tasmania—*B. australe;* Samoa—*B. daucifolium;* Java—*B. daucifolium* var. (?)

North America (8): *B. obliquum* (Eastern and Southern), *B. obliquum intermedium* (Northeastern), *B. dissectum* (Eastern), *B. matricariae* (Northeastern), *B. biternatum* (Southern), *B. Coulteri* (Rocky Mountains), *B. silaifolium* (Pacific Coast), *B. occidentale* (British Columbia), *B. decompositum* (Mexico).

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* Enum. pl. in Japonia sponte crescentium, 2: 252. 1879.

South America: Two species undescribed from Colombia and Argentina.

Besides the above, there are two forms from Mexico, one from Alaska, one from Guatemala and one from Jamaica, too little known at present for accurate description and limitation.

Possibly a brief account of the materials which have been examined may be of interest as it will apply as well to other genera of ferns, which have been studied already. The Kew herbarium has by far the richest series in the world, based on Hooker's original collection and supplemented by extensive collections in British colonies and many others variously obtained, among them the finest series of duplicates from Fée's rich gatherings that we have seen. In this group of *Botrychium* there are at Kew 138 specimens.

The Berlin collection stands next in value in Europe, representing in addition to types of Willdenow, Sturm, and Kunze, the extensive collection of Mettenius, and Hildebrand's Hawaiian Island herbarium. It also contains the results of the work of Kuhn and Prantl, the untimely death of each of whom has deprived Germany of a master in pteridology. In this group we found 108 specimens at Berlin, there being an unusually large series of *B. matricariae*.

The Paris collection is small and poor, though much valuable material (including Fournier's types) is unmounted and stored in the attics of the old fire trap in which it is housed. It is a noteworthy fact that the best collections from the French colonies and the specimens of the French pteridologist, Fée, are best represented not at Paris, but at Kew and Berlin; we found only 34 specimens of this group at Paris.

The American public collections are better known on this side of the water and contain naturally a vastly better representation of the plants of the United States (though not of Mexico and the West Indies), than do those of Europe. The Gray Herbarium furnished opportunity to study 64 specimens of this group, the National Herbarium 40, the Herb. Philadelphia Academy of Sciences 16, and the Columbia Herbarium 50, at least two thirds of which are specimens from the United States. The Canby Herbarium in the College of Pharmacy, New York, the herbarium of Lafayette College, kindly loaned by Dr. Porter before the fire, the herbarium of the California Academy of Sciences and that of Cornell University furnished each additional material of interest.

Of private collections, that of Walter Deane, though of limited range, contains the finest specimens from the Eastern States, some of them of matchless perfection, in all 39 specimens; that of Professor D. C. Eaton is very rich in forms, with 77 specimens; that of Mr. Davenport with 44 specimens from this group, many of which are scrappy, contains a number of interesting forms; these together with 112 specimens in our own herbarium, to say nothing of literally thousands of specimens examined in the field have furnished the data for this paper. Very much is yet to be known, particularly of the species of Mexico, West Indies, and South America.

COLUMBIA UNIVERSITY,
1 August 1898.

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A Correction.

In the March number of the BULLETIN an unfortunate error occurred resulting in the necessity of renaming a species there described. We suggest the following emendation:

SELAGINELLA ARENICOLA Underw.

Selaginella arenaria Underw. Bull. Torr. Bot. Club, **25**: 129, 1898, not *S. arenaria* Baker.

L. M. UNDERWOOD.

8 OCTOBER 1898.

An Enumeration of the Plants Collected by Dr. H. H. Rusby in South America, 1895–1896.—XXV.

By H. H. Rusby.

(Continued from Bull. Torr. Bot. Club, **25**: 500. 10 S. 1898.)

Stigmatic disk circular, slightly convex, the center sharply depressed : fruit unknown.

A glabrous twining shrub, the habit that of *Blepharodon*, the small (yellowish ?) flowers loosely umbelled in one or both axils, the umbels short-peduncled.

The genus is dedicated to Miss Anna Murray Vail, to whom we are indebted for much valuable information concerning the relations of American Asclepiadaceae.

VAILIA MUCRONATA.

Branches elongated, slender, terete, green, the internodes 3–5 cm. long : petioles about 1 cm. long : blades 4–6 cm. long, 1–2 cm. broad (on the older branches twice this size), lance-oblong, the base blunt to rounded, the apex acute and strongly and stiffly mucronate, dark-green above, pale underneath, the midrib very broad, reddish, like the (about) 20 pairs of secondaries : peduncles mostly shorter than the petioles, about 5–7-flowered, the pedicels nearly twice the length of the peduncles, stoutish : calyx 3.5 mm. broad, divided more than half way, the segments broadly ovate : corolla nearly 1 cm. broad when fully expanded, divided two-thirds of the way, the segments ovate, glabrous : outer ligule erect, a little shorter than the stamen-column, ovate, obtuse : inner ligule erect, ovate, obtuse, twice as broad as the outer, about as long as the stamen-column, its upper half free.

Bolivia. (Nos. 1275 and 2547.) The same as Bang's no. 2058.

LOGANIACEAE.

SPIGELIA ELONGATA Britton sp. nov.

Rhizome short, suberect, stout, woody : roots stout, with numerous elongated, widely spreading branches : stem erect, .5–1 m. high, loosely branched above, terete or bluntly and irregularly angled above, strigose, grayish-green, the internodes mostly about 6 or 8 cm. long : lower leaves sometimes ternately whorled, only

1 or 2 cm. long, the upper somewhat irregularly opposite, the stipular lines obscure, their blades 5–15 cm. long by 2–8 cm. broad, contracted abruptly into petioles 1–2 cm. long, varying from oblong or oval to ovate or obovate, very short-pointed, obtuse to acutish, inaequilateral, entire, thin, bright-green, underneath pale and sparingly short-strigose, above more sparsely so, but the hairs a little longer, the midrib and 8–10 irregularly placed pairs of secondaries prominent underneath: spikes solitary or in pairs at the ends of the branches, very short-peduncled, 1–2 dm. long, very slender, strictly secund, coarsely angled, gray, strigose, the fruits 2 or 3 mm. apart: calyx-tube nearly obsolete, the lobes about 2 mm long, attenuate from a short broad base, erect or more or less spreading in fruit: corolla strongly 5-angled, yellowish, the angles green, strigose, 3–4 mm. long, the tube about three fifths of the length, its upper half contracted, the lobes about 1 mm. long, rounded, the anthers nearly 1 mm. long, inserted at the contracted portion, their position marked externally by 5 projecting pockets between the angles: ovary 1 mm. high, slightly broader, the stigma sessile, rounded: capsule strongly compressed, about 3 mm. broad, and half as long, yellowish-brown, minutely tuberculate.

Reis, 1500 feet, June, 1886 (no. 1431). The same as Bang's no. 2507 and near to Kalbreyer's no. 1658, from Antioquia.

SPIGELIA SESSILIFOLIA sp. nov.

Rhizome short: root much branched: stem erect, slender, sparsely branched above, the branches slender, erect, both stem and branches terete, or the latter minutely angled above, green, glabrous: leaves ternately whorled, sessile, connected by stipular membranes, 1–1.5 dm. long, 2.5–5 cm. broad, ovate, the base abruptly contracted, the apex long-acuminate and acute, thin, bright-green, very sparsely and very shortly strigose above, glabrous underneath, the midrib and 5 or 6 pairs of secondaries weak, yellowish, not prominent: spikes terminal, apparently always solitary, long-peduncled, very slender, strictly secund, 2 or 3 dm. long, the fruits 4 or 5 mm. apart: flowers subsessile: the calyx 1.5 mm. broad, the lobes 2 or 3 mm. long, strictly erect, attenuate from a broad base: corolla 1.5 cm. long, infundibular, 5 mm. broad at the top, the lobes ovate, obtuse, 2 or 3 mm. long: anthers 1 mm. long, inserted about the junction of the middle and upper thirds: style thick, apparently succulent, 1 cm. long, white-pilose upward: mature fruit not seen.

Mapiri, 5000 ft., April, 1886 (no. 1429).

Buddleia andina Britton ex Rusby, Mem. Torr. Bot. Club, **4**: 222. Vic. La Paz, 11000 ft., April, 1885 (no. 2050).

BUDDLEIA MONTANA Britton sp. nov.

A tree, 3–5 m. high, the trunk 1.5–3 dm. in diameter, the branches widely spreading, brittle, the branchlets numerous, stoutish, densely black- and yellow-scurfy-tomentose, as are the lower leaf-surfaces and the inflorescence: petioles very short and broad, the blades 2–8 cm. long, 7–15 mm. broad, oblong, somewhat obtuse, thick, the upper surface dark and shining, strongly and finely reticulate, the midrib impressed and yellow-tomentose, the 20 or more pairs of secondaries and the veinlets prominent, very slender: flowers somewhat crowded in the panicles, which are short-peduncled, 2–4 cm. long and one-half as broad: flowers mostly very short-pedicelled; bracts subulate, mostly shorter than the calyx: calyx densely yellow-tomentose, campanulate, 3 or 4 mm. long and broad, 4-lobed, the lobes triangular-ovate, obtuse, one-half as long as the tube: corolla dark-red-purple, thick, tomentose without, the tube campanulate, about as long as the calyx, the lobes of about the same length, rounded, strongly recurved: anthers subsessile in the sinuses, slightly exserted, elliptical-oval, 1.5 mm. long: ovary tomentose, sub-globular, 1.5 mm. in diameter: style blackish, stout, together with the large stigma 1.5 mm. long: mature fruit not seen.

Sorata, 13000 ft., Feb., 1886 (no. 2462). Also seen growing in the city park of La Paz, there said to be highly poisonous. The same as Mandon's no. 346 and Bang's no. 1838.

Desfontainia spinosa R. & P. Fl. Per., **2**: 47. *pl. 186.* Unduavi, 12000 ft., Oct., 1885 (no. 1950). A beautiful dense shrub, 6–8 ft. high, growing in sphagnum bogs on mountain tops, the flowers of a rich crimson.

Desfontainia parvifolia D. Don, Edinb. Phil. Jour. (July–Sept., 1831), 275. Mapiri, 10000 ft., April, 1886 (no. 1951). Grows like the last.

GENTIANACEAE.

Leiphaimos aphylla (Jacq.) Gilg; Eng. & Prantl, Nat. Pflanzenfam. $\mathbf{4}^2$: 104 (*Gentiana aphylla* Jacq. Enum. Pl. Carib. 17; Select. Am. 87. *Voyria aphylla* Pers. Syn. **1**: 284). Mapiri, 2500 ft. May, 1886 (no. 857). Grows in rich mould, in dense forests.

Coutoubea ramosa Aubl. Pl. Gui. **1**: 74. *pl. 28.* Falls of Madeira, Brazil, Oct., 1886. Specimen without number.

MACROCARPAEA sp., apparently undescribed, near *M. Bogotense* Gilg. Yungas, 4000 ft. 1885 (no. 1172). Mature leaves wanting.

Symbolanthus Rusbyanus Gilg, Eng. Bot. Jahrb. **22**: 344. 1896. Mapiri, 5000 ft., April, 1886 (no. 1227). A widely branching, soft-woody shrub, with dark-green foliage and abundant, enduring flowers, varying from orange and scarlet to deep crimson. One of the most beautiful of the Andean plants, and well adapted to cultivation for cut flowers.

Chelonanthus acutangulus (R. & P.) Gilg; Eng. & Prantl Nat. Pflanzenfam. **4**^{2}: 98. (*Lisianthus acutangulus* R. & P. Fl. Per. **2**: 14.) Yungas, 4000 ft., 1885 (no. 1050). The same as Holton's 471, *fide* Britton. A tall weed, with sulphur-yellow flowers, growing along roadsides and in the borders of fields.

Rusbyanthus cinchonifolius Gilg; Eng. & Prantl Nat. Pflanzenfam. **4**^{2}: 95. Mapiri, 5000 ft., April, 1886 (no. 1173). Grows in dense forest, the stem subherbaceous, hollow, 8–10 ft. high, branching slightly at the summit, the flowers cream-colored.

Gentiana sedifolia H.B.K. Nov. Gen. et Sp. **3**: 173. *pl. 225.* Yungas, 10000 ft., 1885 (no. 674). Also collected at Mapiri, April, 1886, and at Unduavi. Grows in wet places, in short grass, and amongst mosses, the flowers whitish-blue.

Gentiana Soratensis Gilg, Eng. Bot. Jahrb. **22**: 332. 1896. Mapiri, 8000 ft., April, 1886 (no. 675). Grows in sphagnum bogs.

Gentiana primulifolia Griseb. Gen. et Sp. Gent. 221. Vic. La Paz, 10000 ft., Oct., 1885 (no. 673). Grows on high, open, wet land, among short grass.

Gentiana puniceа Wedd. Chlor. And. **2**: 70 (?). The calyx-lobes appear too short, and the radical leaves different. Ingenio del Oro, 10000 ft., Mar., 1886 (no. 671).

GENTIANA TRADESCANTIIFOLIA Britton sp. nov.

Stems ascending from a very long, procumbent, rhizome-like base upon which the internodes are about 1 cm. long, thickish but weak, yellow or reddish, 5 dm. or more high, the upper internodes

(*To be continued.*)

New Plants From Wyoming.—IV.

By Aven Nelson.

GILIA CAESPITOSA (Nutt.).

Gilia pungens caepitosa A. Gray, Proc. Am. Acad. **8**: 268. 1870.

Leptodactylon caespitosum Nutt. Jour. Acad. Philad. II. **1**: 157. 1847.

Perennial, densely caespitose, the much-branched woody base hardly emergent from the soil: stems numerous and very short, clothed with the persistent crowded leaves: leaves alternate, palmately 3-parted (rarely 5-parted), densely fascicled, rigid, subulate-pungent, 5–7 mm. long, nearly glabrous or somewhat ciliate on the margins, green as to the new leaves, the short stems gray with the persistent dead ones: flowers numerous: calyx one-half the length of the corolla tube, its lobes 4 (rarely 5), acerose: corolla white to yellowish, salverform, tube very slender and but little dilated at the throat, about 12 mm. long, lobes 4, narrowly obovate, about 4 mm. long: stamens 4, filaments short, anthers in the throat: pistil less than half the length of the corolla-tube, styles 2 or rarely 3.

That this plant should have become associated with *Gilia pungens* can be accounted for only by assuming that Dr. Gray had at hand nothing but scrappy specimens. The two plants in the field do not suggest each other. This grows in low, broad mats, a foot or two across and hardly raised above the soil at all, the compact surface profusely covered with the yellowish flowers. The marked reduction in number in the floral organs, together with the great difference in habit, led me to think that this plant was not to be associated with *G. pungens caespitosa* A. Gray. But Dr. Rydberg who has collected the latter at the type locality, "Scott's Bluff, Wyo." (now Neb.) thinks there can be no doubt of their identity.

It is abundant on the dry, clay and shale bluffs overlooking Green River and in many similar situations eastward in this state. The specimen from which the description is drawn is my no. 3053, Green River, May 30, 1897, but I have this year observed it in many other localities.

GILIA GRAYI.

Gilia caespitosa A. Gray, Proc. Am. Acad. **12**: 80. 1876.

Since it becomes necessary to designate *G. caespitosa* A. Gray, by some other name it may stand as above.

PENTSTEMON JAMESII Benth., DC. Prod. **10**: 325, possibly only in part; A. Gray, Proc. Am. Acad. **6**: 67, in part only.

P. albidus Nutt., Torr. in Ann. Lyc. N. Y. **2**: 229, in part.

Concerning this plant there has arisen some confusion owing to the fact that it has rarely been collected while a somewhat similar plant early found its way into the herbaria under this name. As a result, not only are the specimens in the herbaria misleading, but the later descriptions, having been drawn to cover both plants, are more nearly applicable to the more frequently collected one.

In regard to *P. Jamesii* the facts seem to be about as follows: In 1820, James collected some plants in Colorado or Wyoming which Torrey, in 1828 (Ann. Lyc. N. Y. **2**: 229), referred to *P. albidus* Nutt. In 1846 (?) Bentham separated these, and possibly others somewhat similar, from the true *P. albidus* under the name *P. Jamesii* (DC. Prod. **10**: 325). In 1862, Gray redescribed the species (Proc. Am. Acad. **6**: 67). In the meantime several collections of a more southern plant had been made, notably by Fendler, whose nos. 575 and 579 Gray cites in particular as typical of the species. Recent collections of the true *P. Jamesii* by Dr. P. A. Rydberg in S. Dakota in 1892, and by the writer in the Red Desert of Wyoming in 1897 (no. 3052) and again in 1898 (no. 4716) show that this plant is very different from the more southern one.

Before I began work upon these collections Dr. Rydberg had satisfied himself that his Dakota plant closely duplicated the type of *P. Jamesii* which is preserved in the Torrey Herbarium at Columbia University, and with which he has done me the favor of comparing my specimens also.

To set this matter straight then, it seems well to redescribe the species from the excellent and abundant material now at hand:

Finely but very densely pruinose-pubescent throughout, obscurely glandular upwards: stems 1–several, from a woody, simple or branched caudex, ascending or more rarely erect, usually somewhat decumbent at base, 1–2 dm. high: radical leaves entire or rarely denticulate, numerous, clustered on the crowns, ovate to oblong, from obtuse to subacute, blade 2–4 cm. long, tapering into stout, narrowly margined, somewhat shorter petioles; cauline leaves entire, narrowly oblong, sessile or the lower tapering into margined petioles, 2–5 cm. long: thyrsus leafy-bracteate, dense, from short to much elongated: bracts narrowly oblong to linear, often longer than the flowers: sepals lanceolate, minutely glandular-pubescent, about as long as the short (8 mm.) and broad corolla-tube, which is gradually inflated into the ventricose-campanulate throat: corolla about 2 cm. long, tube shorter than the throat, the rounded lobes subequal, about 5 mm. long, copiously but finely villous on the lower lip: sterile filament bearing a dense tuft of yellow hair at apex (which is slightly exserted) and somewhat similar pubescence for most of its length but sparsely towards its tip; anther cells confluent but not explanate: capsule short, ovoid, acute, at maturity longer than the sepals.

PENTSTEMON SIMILIS.

P. Jamesii Benth; A. Gray, in Proc. Am. Acad. **6**: 67, in large part at least.

The more southern plant referred to above as having given rise to some confusion may receive this name, and the appended description will make its recognition not difficult. It is, in the main, the plant indicated by Dr. Gray, as cited above, and in the Synoptical Flora. The slenderer habit of *P. similis*, its narrower leaves, longer and more ventricose corolla, with its tube longer than the sepals, as well as the difference in the pubescence of the plant in general and the sterile filament in particular make it impossible longer to confuse the two. As representing this species attention may be called to Fendler's numbers before noted, and the recent collections in New Mexico by Wooton and by Heller, distributed as *P. Jamesii.*

Caudex woody, branched; herbaceous stems few to many, slender, leafy, ascending or erect, 2–3 dm. high (including the inflorescence), from glabrate to finely and somewhat sparsely pruinose-pubescent: radical leaves mostly short-petioled, narrowly oblanceolate, 3–7 cm. long (including the petiole), mostly entire; stem leaves sparsely denticulate, from narrowly oblong to linear, 2–5 cm. long, upwardly passing into the small entire bracts: thyrsus narrow, somewhat glandular-pubescent, inclined to be secund: sepals broadly lanceolate, shorter than the corolla-tube; corolla about 2.5 cm. long, sparsely long-hairy within: the tube 8–10 mm. long, abruptly dilated into a broadly cyathiform-campanulate throat: anthers glabrous, confluently one-celled, not explanate; sterile filament bearing some sparse, very long, yellowish-white hairs at the tip, and barbate laterally, near the middle, with close, somewhat reflexed, yellow bristles.

CORRECTIONS.

The names of three recently published species having proved untenable may be replaced as follows:

RUMEX SALINUS. *R. tuberosus* A. Nelson, Bull. Torr. Bot. Club, **25**: 283. 1898.

SENECIO PERENNANS. *S. scaposus* A. Nelson, Bull. Torr. Bot. Club, **25**: 379. 1898. = Senecio [illegible]

SOLIDAGO PULCHERRIMA. *S. diffusa* A. Nelson, Bull. Torr. Bot. Club, **25**: 378. 1898.

A Synopsis of the Proceedings of the Botanical Organizations meeting in Boston, August 19–27, 1898.

THE BOTANICAL SOCIETY OF AMERICA.

The fourth annual meeting was held at Boston, August 19 and 20, under the presidency of Dr. N. L. Britton.

In the absence of Prof. C. R. Barnes, Secretary, Dr. B. L. Robinson was elected Secretary *pro tem.*

The following new members were elected : Robert A. Harper, University of Wisconsin, Madison ; Edward A. Burt, Middlebury College, Middlebury, Vt.; Herbert J. Webber, Department of Agriculture, Washington, D. C. ; L. H. Pammel, Iowa Agricultural College, Ames ; Albert S. Hitchcock, Kansas Agricultural College, Manhattan ; Herbert Maule Richards, Harvard University, Cambridge, Mass. ; David G. Fairchild, Department of Agriculture, Washington, D. C. ; David M. Mottier, University of Indiana, Bloomington.

In the absence of the retiring President, Prof. John M. Coulter, his address, entitled "The Origin of Gymnosperms and the Seed Habit," was read by Dr. B. M. Davis.

The following papers were presented :

1. On Sporogenesis in *Arisaema.* By Prof. George F. Atkinson.

2. Symbiotic Saprophytism. By Prof. D. T. MacDougal.

3. Sporogenesis in *Trillium.* By Prof. Geo. F. Atkinson.

4. The structure and Development of the Centrosphere in *Corallina.* By Dr. B. M. Davis.

5. Relations Between the Forest Flora and Geological Formations in New Jersey. By Dr. Arthur Hollick.

6. Preliminary Notes on the Fertilization of the White Pine. By Miss M. C. Ferguson (by invitation of the Council).

7. Notes on a *Helianthus* from Long Island. By Dr. N. L. Britton.

8. Tetrad-formation in *Tsuga.* By W. A. Murrill. (Presented by Prof. Atkinson.)

9. A Fossil Moss from the State of Washington. By Mrs. E. G. Britton and Dr. Arthur Hollick.

The following officers were elected for the ensuing year: President, Prof. L. M. Underwood; Vice-President, Dr. B. L. Robinson; Treasurer, Dr. Arthur Hollick; Secretary, Prof. Geo. F. Atkinson; Councillors, Prof. C. E. Bessey and Dr. W. P. Wilson.

TITLES OF PAPERS READ BEFORE THE SECTION OF BOTANY, A.A.A.S., BOSTON MEETING (FIFTIETH ANNIVERSARY).

W. G. Farlow, Cambridge, Mass., Vice-President; Erwin F. Smith, Washington, D. C., Secretary.

Address by Vice-President Farlow. Subject: "The Conception of Species as affected by Recent Investigations on Fungi." Other papers were read as follows:

1. The Carposporic Type of Reproduction of Rhodophyceae. By Bradley M. Davis, University of Chicago, Chicago, Ill.

2. The Comparative Anatomy of the Pistils of Apocarpous Families. By Ernst A. Bessey, Lincoln, Nebraska. (Abstract by Secretary.)

3. Origin and Homologies of Blepharoplasts. By Herbert J. Webber, Department of Agriculture, Washington, D. C.

4. The Blepharoplast in the Spermatogenesis of *Marsilea*. By W. R. Shaw.

5. Observations on the Relative Moisture Content of Fruit Trees in Winter and in Summer. By C. S. Crandall, Fort Collins, Col. (Abstract by Secretary.)

6. Some Investigations bearing upon the Symbiotic Mycoplasm Theory of Grain Rust. By Henry L. Bolley, North Dakota Experiment Station, Fargo, N. Dak.

7. Starch Distribution as Affected by Fungi. By Byron D. Halsted, New Jersey State Exp. Station.

8. Some Examples illustrating Modes of Seed Dispersion. By W. J. Beal.

9. The Effect of an Atmosphere of Ether upon Seeds and Spores. By C. O. Townsend, Maryland Agricultural College.

10. The Toxic Action of a certain Group of Compounds. By Rodney H. True, University of Wisconsin.

11. Types of Vegetation on the Keys of South Florida. By Charles Louis Pollard, Washington, D. C.

12. Potato as a Culture Medium, with some Notes on a Synthesized Substitute. By Erwin F. Smith, Department of Agriculture, Washington, D. C.

13. Some little-used Culture Media which have proved valuable for Species Differentiation. By Erwin F. Smith.

14. Temperature and Transportation of Desert Plants. By D. T. MacDougal, University of Minnesota.

15. The Brown Spot Disease of Apple Leaves, *Phyllosticta pirina*, and fungus forms associated therewith. (Observations on the occurrence of four fungus forms in association with the above species.) By William B. Alwood, Va. Exp. Sta.

16. Notes on Some Diseases of southern Pines. By Hermann von Schrenk, Missouri Botanic Garden, St. Louis, Mo.

17. Remarkable increase in the Size of Leaves of *Kalmia angustifolia*, apparently due to Reduction of Light. By W. J. Beal, Michigan Agricultural College. (Abstract by author.)

18. Half Shade and Vegetation. By Byron D. Halsted, New Jersey Agricultural Experiment Station, New Brunswick, N. J.

19. Influence of a Wet Spring on Parasitic Fungi. By Byron D. Halsted.

20. The Botanic Garden at Buitenzorg, Java. (Lantern slide lecture.) By David G. Fairchild, United States Department of Agriculture.

21. Notes on the Strand Flora of Florida. (Lantern slide lecture.) By Herbert J. Webber, United States Department of Agriculture.

22. Notes on the Relative Infrequency of Fungi upon the Trans-Missouri Plains and the Adjacent Foothills of the Rocky Mountains. By Charles E. Bessey, University of Nebraska, Lincoln, Neb. (Read by title owing to the number of papers on the program.)

23. Fermentation without live Yeast Cells. By Katherine E. Golden, Lafayette, Ind., and Carleton G. Ferris.

24. Deterrent Action of Salt in Yeast Fermentation. By Katherine E. Golden.

25. Fungus Gardening as practiced by the Termites in West Africa and Java. By O. F. Cook, United States National Museum, and D. G. Fairchild, Department of Agriculture, Washington, D. C.

26. The Biology of Cheese Ripening. By S. M. Babcock and H. L. Russell, University of Wisconsin.

27. Leaves of Red Astrachan Apples immune from the Attack of *Gymnosporangium macropus*. By W. J. Beal, Agricultural College, Mich.

28. On the Occurrence of a Yeast Form in the Life Cycle of *Sphaeropsis malorum* Peck. (An account of discovery and isolation of a yeast form of the above species and its position in reproduction of the species.) By William B. Alwood, Virginia Exp. Station.

29. Observations on Stewart's Sweet-corn Germ. By Erwin F. Smith, Washington, D. C.

30. A Bacteriological Study of Pear Blight. By Lillian Snyder, Lafayette, Ind.

31. Life History and Characteristics of the Pear Blight Bacillus. By Merton B. Waite, United States Department of Agriculture.

32. Effects of Fertilizers on the Germination of Seeds. By Gilbert H. Hicks, Department of Agriculture, Washington, D. C.

33. Development of the Pollen Grain in *Symplocarpus* and *Peltandra*. By B. M. Duggar, Cornell University, Ithaca, N. Y.

34. The Embryology of *Taxus*. By E. J. Durand, Cornell University, Ithaca, N. Y.

35. Notes on some Monocotyledonous Embryo-sacs. By K. M. Wiegand, Cornell University, Ithaca, N. Y.

36. Studies relative to the Perigynium of the Genus *Carex*. By K. M. Wiegand, Cornell University, Ithaca, N. Y.

37. Observations on some Hybrids between *Drosera intermedia* and *Drosera filiformis*. By J. M. Macfarlane, University of Pennsylvania.

38. On the Rapidity of Circumnutation Movements in Relation to Temperature. By E. Simons and R. E. B. McKenney, University of Pennsylvania. (Abstract by the Secretary.)

39. General Characteristics of the Dune Flora of Southeastern Virginia. By Thomas H. Kearney, Jr., United States Department of Agriculture, Washington, D. C.

40. Vegetation of the Wooded Fresh-water swamps of Southeastern Virginia. By Thomas H. Kearney, Jr. (Withdrawn by the author.)

41. On the Validity of the Genera *Senna* and *Chamaecrista*. By Charles Louis Pollard, National Museum, Washington, D. C.

42. Species Characters among the Violets. By Charles Louis Pollard. (Withdrawn by the author.)

43. Notes on Arctic Willows. By W. W. Rowlee, Cornell University, Ithaca, N. Y.

44. Some Steps in the Life History of Asters. By Edward S. Burgess, Normal College, New York City.

45. The Pleistocene and Plant-distribution in Iowa. By T. H. Macbride. (Abstract by author.)

46. A self-registering Transpiration Machine. By Edward Bingham Copeland, Jacksonville, Fla.

47. Methods of studying the Sap Pressure of the Sugar Maple. By L. R. Jones, Burlington, Vt.

48. Notes on the Physiology of the Sporophyte of certain Mosses. By Rodney H. True, Wingra Park, Madison, Wis.

49. The Seeds and Seedlings of some Amentiferae. By W. W. Rowlee and George T. Hastings, Cornell University, Ithaca, N. Y.

50. The Morphology and taxonomic Value of the Fruits of Grasses. By P. Beveridge Kennedy, Cornell University, Ithaca, N. Y.

On motion, in absence of authors, nos. 51–56 were read by title.

51. The Caryopsis of the Gramineae. By L. H. Pammel, State Agricultural College, Ames, Iowa.

52. The ecological Distribution of Colorado and Wyoming Plants. By L. H. Pammel, Ames, Iowa.

53. Fertilization of the Muskmelon Flower. By F. William Rane, Durham, N. H.

54. Notes on Destroying *Comptonia asplenifolia*. By F. William Rane, Durham, N. H.

55. Length of Time from Blossoming until Seed Development of *Leucanthemum vulgare*. By F. William Rane.

56. The Work performed by the Agricultural College toward a Botanical Survey of Michigan. By W. J. Beal, Agricultural College, Ingham Co., Mich.

Seven additional titles were handed in, but were omitted from the program owing to the fact that no abstracts had been furnished. It was suggested that these papers might be read before the Botanical Club, in case the authors should be in attendance at its meeting.

It was voted, contrary to the recommendation of the committee having the matter in charge, that literature relating to Bacteriology should be included in the "Index of recent Literature relating to American Botany."

BOTANICAL CLUB OF THE A. A. A. S.

D. T. MacDougal, Minneapolis, Minn., Acting President, in absence of the President and Vice-President elected at the Detroit meeting; A. B. Seymour, Cambridge, Mass., Secretary.

The following papers were read:

1. Note on the Influence of Eskers upon Plant Distribution in Maine. By M. L. Fernald.

2. Some peculiar Features of Synapsis in the Pollen-Mother-Cells of Monocotyledons. By K. M. Wiegand.

3. The future Growth of *Taxodium distichum*. By Hermann von Schrenk.

4. Progress of the Work on the Buffalo Botanic Garden. By John F. Cowell.

5. The Nucleolus during the Division of the Pollen-Mother-Cells in *Begonia*. By B. M. Duggar.

6. Is the present Treatment of the Species of *Hydrophyllum* a natural one? By K. M. Wiegand.

7. An Apparatus for washing Material killed by certain Fixtures. By E. J. Durand.

8. Notes on the Occurrence near Boston of some fleshy Fungi. By Hollis Webster.

9. The Influence of Temperature upon *Sporotrichum globuliferum*. By B. M. Duggar.

10. North American Ustilagineae. By A. B. Seymour.

11. On Labels for Greenhouses and out-door Plants. By W. A. Kellerman.

12. The Catapult Expulsion of Seeds of *Razoumofskya* in the Colorado Cañon. By D. T. MacDougal.

As officers of the Club for the ensuing year, the following were elected: Byron D. Halsted, President; F. H. Knowlton, Vice-President; Stewardson Brown, Secretary.

Adjourned to meet at 9 A. M. of the second day of the next A. A. A. S. meeting.

LINNAEAN FERN CHAPTER OF THE AGASSIZ ASSOCIATION.

Under the auspices of the above-named organization a well attended meeting was held at Upper Horticultural Hall, Boston, August 24th. The following papers were presented:

1. Hybridity in Ferns. By Geo. E. Davenport.

2. An interesting Variety of *Osmunda Claytoniana*. By A. J. Grout.

3. The Ferns of the Urals and Caucasus (a letter of travel). By Miss Mary A. Fleming.

4. Distribution of Ferns of Eastern America. By Willard N. Clute.

5. On the Genera of Ferns: a study of the tribe Aspidieae. By B. D. Gilbert.

6. Notes on a peculiar *Botrychium*: illustrated by 300 specimens. By A. A. Eaton.

7. A Study of *Ophioglossum vulgatum*: illustrated by large collections. By Mrs. E. G. Britton.

Index to recent Literature relating to American Botany.

Barnhart, J. H. A new species of *Utricularia.* Bull. Torr. Bot. Club, **25**: 515–516. 8 S. 1898.

Utricularia macrorhyncha Barnhart.

Bray, W. L. On the Relation of the Flora of the Lower Sonoran Zone in North America to the Flora of the arid Zones of Chili and Argentine. Bot. Gaz. **26**: 121–147. 15 Au. 1898.

Britton, E. G. Mosses of Northern India. Bull. Torr. Bot. Club, **25**: 398. 15 Jl. 1898.

Review of Brotherus' "Contributions to the Bryological Flora of the Northwestern-Himalayas."

Cockerell, T. D. A. A new Southwestern Sophia. Bull. Torr. Bot. Club, **25**: 460. 13 Au. 1898.

Cook, A. C. A Sketch of the Flora of the Canary Islands. Bull. Torr. Bot. Club, **25**: 351–358. 15 Jl. 1898.

Davidson, A. The Lupines of Los Angeles County, California. Erythea, **6**: 70–72. 31 Jl. 1898.

Earle, F. S. New or noteworthy Alabama Fungi. Bull. Torr. Bot. Club, **25**: 359–367. 15 Jl. 1898.

New species in *Micropeltis*, *Anthostomella*, *Botryosphaeria*, *Gnomonia*, *Metasphaeria*, *Trichosphaeria*, *Nectria*, *Aulographum*, *Lophodermium*, *Cercospora* and *Phyllosticta; Leptosphaeria eumorpha* (B. & C.) nom. nov.

Eastwood, A. Is *Xerophyllum tenax* a septennial? Erythea, **6**: 75–76. 31 Jl. 1898.

Eastwood, A. Notes on the Flora of Marin County, California. Erythea, **6**: 72–75. 31 Jl. 1898.

Ellis, J. B., and **Everhart, B. M.** New Species of Fungi from various Localities. Bull. Torr. Bot. Club, **25**: 501–514. 8 S. 1898.

Sp. nov. in *Chaetomium*, *Cordyceps*, *Coprolepa*, *Melanomma*, *Zignoella*, *Teichospora*, *Lophiostoma*, (?) *Sphaerella*, *Didymella*, *Ophiobolus*, *Pleomassaria*, *Melanconis*, *Fenestella*, *Homostegia*, *Pezicula*, *Dasyscypha*, *Phaeopeziza*, *Calloria*, *Uromyces*, *Puccinia*, *Ravenelia*, *Phoma*, *Asteroma*, *Fusicoccum*, *Sphaeropsis*, *Diplodina*, *Hendersonia*, *Septoria*, *Cornularia*, *Cryptosporium*, *Botrytis*, *Isaria*, and *Cercospora* ; *Didymochaeta* Sacc. & Ell. gen. nov. with one species, *D. Americana* Sacc & Ell.

Evans, A. W. An Enumeration of the Hepaticae collected by John B. Hatcher in Southern Patagonia. Bull. Torr. Bot. Club, **25**: 407–431. *pl. 345–348.* 13 Au. 1898.

Blepharostoma pilosum and *Jungermannia Hatcheri*, sp. nov., with critical notes on other species.

Grout, A. J. A Revision of the North American Isotheciaceae and Brachythecia. Mem. Torr. Bot. Club, **6**: 131–210. 30 Jl. 1897.

Contains critical descriptions of the North American species. *Brachythecium Leibergii* sp. nov. and several new varieties are proposed.

Halsted, B. D. Two Phaenogamous Parasites of the Red Clover. Bull. Torr. Bot. Club, **25**: 395–397. 15 Jl. 1898. [Illust.]

Heald, F. DeF. Conditions for the Germination of the Spores of Bryophytes and Pteridophytes. Bot. Gaz. **26**: 25–45. *pl. 4.* 28 Jl. 1898.

Hill, E. J. *Eleocharis melanocarpa* a proliferous Plant. Bull. Torr. Bot. Club, **25**: 392–394. *pl. 344.* 15 Jl. 1898.

Hill, E. J. Two noteworthy Oaks. Bot. Gaz. **26**: 53–57. *pl. 5, 6.* 28 Jl. 1898.

Quercus coccinea × *palustris* and a teratological form of *Q. coccinea* (?).

Howe, M. A. The Porella Question. Rev. Bryol. **25**: 75–78. 1898.

Johnson, D. S. On the Leaf and Sporocarp of *Pilularia.* Bot. Gaz. **26**: 1–24. *pl. 1–3.* 28 Jl. 1898.

Keller, R. Ueber die central und südamerikanischen Hyperica des Herbarium Hauniense. Bull. Herb. Boiss. **6**: 253–268. Ap. 1898.

Lemmon, J. G. Notes on West-American Coniferae.—VIII. Erythea, **6**: 77–79. 31 Au. 1898.

Levier, E. *Porella* annulé par le Code de Rochester. Bull. Herb. Boiss. **6**: 496–502. Je. 1898.

Lovell, J. H. The Insect-Visitors of Flowers. Bull. Torr. Bot. Club, **25**: 382–390. 15 Jl. 1898.

Müller (Hal.), C. Bryologia Serrae Itatiaiae (Minas Geraës Brasiliae) adjectis nonnullis Speciebus affinibus Regionum vicinarum. Bull. Herb. Boiss. **6**: 18–48. Ja. 1898; 89–126. F. 1898.

Nash, G. V. A Revision of the Genera *Chloris* and *Eustachys* in North America. Bull. Torr. Bot. Club, **25**: 432–450. 13 Au. 1898.

Chloris tenuispica and *C. brevispica*, sp. nov., and *Chloris Nealleyi*, *C. latisquamea*, *C. Texana* (Vasey), and *Eustachys neglecta*, nom. nov.

Nelson, A. New Plants from Wyoming.—III. Bull. Torr. Bot. Club, **25**: 373–381. 15 Jl. 1898.

New species in *Arabis*, *Vicia*, *Philadelphus*, *Angelica*, *Chrysothamnus*, *Solidago*, *Senecio*, *Pentstemon*, and *Emmenanthe*; *Oonopsis Wardi condensata*, var. nov., and *Picradenia ligulaeflora*, nom. nov.

Peck, C. H. New Species of Alabama Fungi. Bull. Torr. Bot. Club, **25**: 368–372. 15 Jl. 1898.

New species in *Lepiota*, *Lactarius*, *Russula*, *Omphalia*, *Panus*, *Boletus*, *Thelephora*, and *Clavaria*.

Piper, C. V. A new Violet from Washington. Erythea, **6**: 69. 31 Jl. 1898.

Viola Flettii Piper.

Porter, T. C. The Flora of the Lower Susquehanna. Bull. Torr. Bot. Club, **25**: 485–494. 8 S. 1898.

Robinson, B. L. Notes on the Genus *Bartonia*. Bot. Gaz. **26**: 46–48. 28 Jl. 1898.

Bartonia iodandra sp. nov.

Rusby, H. H. An Enumeration of the Plants collected by Dr. H. H. Rusby in South America, 1885–1886.—XXIV. Bull. Torr. Bot. Club. **25**: 495–500. 8 S. 1898.

A continuation of the series of papers begun by Dr. N. L. Britton. *Mandevillia Mandoni* Rusby, *Metastelma* (*Eumetastelma*) *Matthewsii* Rusby, *Tassadia Sprucei* Rusby, *Ditassa racemosa* Britt., and *Gonolobus Brittonii* Rusby, sp. nov. and *Vailia* Rusby, gen. nov.

Small, J. K. Abnormal Inflorescence in *Saxifraga fallax*. Bull. Torr. Bot. Club, **25**: 391. *pl. 343*. 15 Jl. 1898.

Small, J. K. Studies in the Botany of the Southeastern United States.—XIV. Bull. Torr. Bot. Club, **25**: 465–484. 8 S. 1898.

New species in *Nymphaea*, *Aquilegia*, *Heuchera*, *Euphorbia*, *Sida*, *Rhexia*, *Conradina*, *Koellia*, *Pentstemon*, *Lacinaria*, *Solidago*, *Silphium*, *Rudbeckia*, *Helianthus*, *Bidens*, *Marshallia*, and *Melothria*.

Stewart, F. C. Experiments and Observations on some Diseases of Plants. Bull. N. Y. (Geneva) Exp. Sta. 138: 626–644. D. 1897.

Stone, G. E., and **Smith, R. E.** Report of the Botanists, 10th Ann. Rep. Mass. (Hatch) Exp. Sta., 47–70. *pl. 1, 2*. Ja. 1898.

Stoneman, B. A comparative Study of the Development of some Anthracnoses. Bot. Gaz. **26**: 69–120. *pl. 7–18*. 15 Au. 1898.

Gnomoniopsis, gen. nov., is proposed, with five species, viz.: *G. cingulata* (Atk.) *G. piperata* (E. & E.), *G. cincta* (Berk. & Curt.), *G. rubicola* (E. & E.) and *G. ? vanillae* Stoneman; *Gloeosporium naviculisporum*, *G. cactorum*, *G. foetidophilum*, *Volutella citrulli* and *V. violae*, are also described as new.

Waugh, F. A. Notes on sundry American Plums. Bot. Gaz. **26**: 48–53. 28 Jl. 1898.

Wooton, E. O. New Plants from New Mexico.—III. Bull. Torr. Bot. Club, **25**: 451–459. 13 Au. 1898.

New species in *Commelina*, *Philadelphus*, *Linum*, *Martynia*, *Artemisia*, *Sophia*, *Prosopis*, *Parryella*, *Phacelia*, and *Aster*.

[This Index is reprinted each month by the Cambridge Botanical Supply Company in card catalogue form.]

Contributions from the Herbarium of Columbia College.

[The numbers omitted from this list are out of print.]

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BULLETIN

OF THE

TORREY BOTANICAL CLUB

NOVEMBER 1898

Revision of the Genus Triplasis.

BY GEO. V. NASH.

This group of plants has been frequently considered a part of the genus *Triodia*, founded by Robert Brown on a number of Australian grasses which bear little more than a superficial resemblance to our plants. Hackel * so considered the group, but Bentham & Hooker † adopted the views of Beauvois and gave to it the dignity of generic rank. It has seemed to us for some time that the genus *Triodia* embraced too many forms and that it would be much more satisfactory to divide it into several smaller groups. *Triplasis* approaches most closely to those plants that have been referred to *Triodia* under the specific names of *avenacea*, *pulchella*, *Nealleyi*, etc. The flowering scales are deeply 2-lobed as they are in those plants, but the internodes of the rachilla of the spikelet in *Triplasis* are much elongated and the callus is very long, sometimes two thirds as long as the internodes, and attached to the rachilla by a long oblique angle. The callus being densely pilose on the free side gives the rachilla internodes the appearance of being pilose on one side for a part of their length. This long and manifest callus with its very evident oblique attachment is a character not known to us to occur in any other of the many forms that have been referred from time to time to *Triodia*. The conclusions of Beauvois certainly seem tenable and better serve the end of systematic botany than does

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* Engl. & Prantl, Nat. Pflanzenfam. 2^2: 68. 1887.

† Gen. Plant. 3^2: 1176. 1883.

[Issued 7 November.]

the alternative, the merging of the group with a genus that has, under present conceptions, already passed far beyond the bounds of reason or expediency by having incorporated in it a number of well-marked groups that might much better be treated as genera.

The genus *Triplasis* is not a large one; nor is it extensively distributed, its three species being confined to North America east of the Rocky Mountains, and mainly to the vicinity of the coast, but one species, *T. purpurea*, occurs in the interior. The other two are found only in the coastal region south of Virginia, one of them, *T. intermedia*, being known at present only from Florida.

TRIPLASIS Beauv. Agrost. 81, *pl. 16. f. 10.* 1812.
[DIPLOCEA Raf. Am. Journ. Sci. **1**: 252. 1818.]
[MERISACHNE Steud. Syn. Pl. Gram. 117. 1855.]

Tufted grasses with simple or sparingly branched culms, narrow flat leaves which are usually involute when dry, and terminal and lateral few-branched panicles, the latter concealed in the sheaths. Spikelets few, on short pedicels, 2–4-flowered, the flowers perfect or the upper one staminate; rachilla glabrous, the internodes above the first flowering scale much elongated. Scales 4–6, usually purple or purplish: outer 2 empty, keeled, 1-nerved, acute or acuminate: flowering scales deeply 2-lobed at the apex, the lobes truncate to acuminate and pointed, 3-nerved, the nerves densely pilose with ascending hairs, the awn arising between the lobes, shorter than or exceeding them, pilose for part of its length; callus manifest, densely pilose, wedge-shaped or subulate, obliquely attached to the rachilla, its hairs making the internodes appear as if pilose on one side for part of their length: palet shorter than the scale, compressed, 2-nerved, the nerves pilose, the hairs on the lower part short, those on the upper part abruptly much longer and forming a conspicuous tuft. Stamens 3. Styles short, distinct: stigmas plumose. Grain cylindric, free, loosely enclosed in the scale and palet.

Species 3, confined to North America, principally in the eastern and southern portions.

Key to the Species.

Flowering scale one third or more as broad as long, with a shorter straight awn 3 mm. or less long.
  Lobes of the flowering scale rounded or truncate at the irregularly and minutely toothed apex; awn less than 2 mm. long. 1. *T. purpurea.*
  Lobes of the flowering scale acute or acutish at the apex; awn 2.5–3 mm. long. 2. *T. intermedia.*

Flowering scale one fifth as broad as long, its lobes acuminate, pointed, the awn longer than the scale, 6 mm. or more in length, recurved, at least when dry.
3. *T. Americana.*

1. TRIPLASIS PURPUREA (Walt.) Chapm. Fl. South. U. S. 560. 1860.

Aira purpurea Walt. Fl. Car. 78. 1788.
Uralepis aristulata Nutt. Gen. **1**: 63. 1818.
Diplocea barbata Raf. Am. Journ. Sci. **1**: 253. 1818.
Tricuspis purpurea A. Gray, Man. 589. 1848.
Merisachne Drummondii Steud. Syn. Pl. Gram. 117. 1855.
Triplasis sparsiflora Chapm. Fl. South. U. S. 663. 1884. [2d Ed.]

Culms 2–8 dm. tall, usually less than 6 dm., simple or finally slightly branched, the lower internodes roughened with a minute pubescence, at least below the nodes, and also occasionally sparingly hirsute; nodes numerous, densely upwardly barbed with silky hairs: leaves numerous; sheaths shorter than the internodes, rough, the lower ones sometimes papillose-hirsute at the base; ligule a dense ring of hairs less than 1 mm. long; blades erect or ascending, flat, or involute when dry, less than 15 cm. long, 1–3 mm. wide, rough on both surfaces, the upper surface usually sparingly hirsute, the uppermost leaf reduced to a point: panicle at length exserted, the axis smooth and glabrous, the roughened branches in 1's or 2's, finally widely spreading, 4 cm. or less long, the lower ones usually divided: spikelets on short hispidulous pedicels, usually purple: scales 4 or 5; outer empty 2 acuminate, the first about two thirds as long as the second, which is 3–4 mm. long; flowering scales divided about one quarter way down, the lobes rounded or truncate at the irregularly and minutely toothed apex, the awn equalling or a little exceeding the lobes, pilose on the lower half, less than 2 mm. long, the lowest scale about 4 mm. long, 1.75 mm. wide when spread out: palet shorter than the scale: grain about 2 mm. long.

In sandy soil, usually along the coast, Ontaria to Florida, west to Texas; also along the Great Lakes and from Missouri and Nebraska southward.

The *T. sparsiflora* of Chapman appears to us to be but a form of this species. Mr. C. D. Beadle, Curator of the Biltmore Herbarium, kindly sent us for examination the type specimen. It proves to be a smut-infested plant and therefore a very unsatisfactory one to determine properly, its scales necessarily being abnormal. The whole plant has a very odd look, the inflorescence appearing to be a long narrow panicle. A more careful examination, however, reveals the cause of this unique inflorescence in the breaking away of the upper sheaths, thus exposing the secondary and usually concealed panicles, which are present in the late stage of the species of this genus. This is clearly indicated by the swollen pubescent nodes which occur throughout its length. So far as can be judged from the imperfect condition of the plant, the type specimen, as indicated previously, appears to be but a form of *T. purpurea*, and, for the present at least, its disposition under this species seems to us best. Good specimens may be secured later, and then a correct valuation can be placed upon it. The specimen was collected on the "Sea beach at Punta Rosa, Florida, October, 1875."

2. TRIPLASIS INTERMEDIA sp. nov.

Culms densely tufted, 4–8 dm. tall, slender, smooth, more or less hirsute below with appressed or ascending hairs, simple or at length somewhat branched at the lower nodes; nodes numerous, densely and conspicuously upwardly barbed with silvery hairs: leaves numerous; sheaths from one half to three quarters as long as the internodes, very rough, papillose-hirsute towards the base with long ascending hairs; ligule a dense ring of hairs 1 mm. or less long; blades erect or ascending, 13 cm. or less long, the uppermost one reduced to a mere point, involute when dry, very rough on both surfaces and on the margins, hirsute above and sometimes also sparingly below, scantily papillose-ciliate with very long hairs: panicle at length exserted, the branches in 1's–3's, usually in pairs, finally widely spreading, pubescent at the base, rough, the longer ones 2–4 cm. long and more or less divided: spikelets on short pubescent pedicels, 8–10 mm. long, usually purplish: scales 5 or 6, the sixth when present empty; outer 2 empty scales acuminate, rough on the keel, about equal in length, or the first considerably shorter than the second, which is 4–4.5 mm. long; flowering scales divided from one quarter to one third their length, the lobes acute to somewhat obtuse, the callus subulate, about one half as long as the rachilla internodes, the hairs on the lateral nerves about .5 mm. long, much longer than those on the midnerve, the awn 2.5–3 mm. long, straight, much exceeding the scale, the lowest scale about 4.5 mm. long, 1.5 mm. wide; palet about three quarters as long as the scale: stamens purple, 1.75–2 mm. long.

Dry sandy soil, south peninsular Florida. Collected by the writer at Ballast Point, near Tampa, in the vicinity of the Pavillion, on August 20, 1895, no. 2426. It grew in great abundance about one hundred feet from the shore, forming large dense tufts.

3. TRIPLASIS AMERICANA Beauv. Agrost. 81, *pl. 16. f. 10.* 1812.
Uralepis purpurea Nutt. Gen. **1**: 62. 1818.
Uralepis cornuti Ell. Bot. S. C. & Ga. **1**: 580. 1821.

Culms 3–8 dm. tall, slender, smooth, puberulent, the lower internodes also hirsute with nearly appressed hairs, simple; nodes numerous, sparingly, if at all, barbed: leaves numerous; sheaths much shorter than the internodes, smooth, the lower ones hirsute, often sparingly so, with nearly appressed hairs; ligule a scarious ciliolate ring less than .5 mm. broad; blades flat, usually involute when dry, erect or ascending, 15 cm. or less long, less than 2 mm. wide, the uppermost leaf reduced to a point, rough on the margins, smooth on both surfaces, glabrous beneath or with a few long scattered hairs, the upper surface minutely pubescent, sometimes also with scattered long hairs: panicle at length exserted, the axis smooth and glabrous, the branches ascending, single or in pairs, glabrous, somewhat scabrous, simple or sparingly divided, 3 cm. or less long: spikelets on short hispidulous pedicels, usually purple, the callus subulate, about two thirds as long as the rachilla internodes: scales 4 or 5; outer empty 2 acuminate, the first three quarters or more as long as the second which is 3–4 mm. long; flowering scales divided to the middle, the lobes subulate, acuminate, pointed, the awn much exceeding the scale, usually reflexed, at least when dry, pilose for about two thirds its length, 6–8 mm. long, the lowest scale about 5 mm. long, about 1 mm. broad: palet a little more than one half as long as the scale: grain about 2 mm. long.

Dry sandy soil along the coast, North Carolina to Florida, west to Texas.

Piperaceae Bolivianae.

By Casimir De Candolle.

PIPER L.

Sectio 2. *Enckea* C. DC. Prodr. **16**^{1}: 243.

1. P. tenue Kunth in H. et B. Nov. Gen. **1**: 56.

In Bolivia ad confluentem fluminum Beni et Madre de Dios (Rusby, no. 2184 in Herb. Boiss.).

Sectio 3. *Steffensia* C. DC. *l. c.*, 251.

2. P. Warakaboura C. DC. Prodr. **16**^{1}: 257.

In Bolivia ad confluentem fluminum Beni et Madre de Dios, Augusto (Rusby, no. 2182 in Herb. Columbia University).

3. P. Bangii C. DC. Bull. Torr. Bot. Club, **19**: 49. 1892.

In Boliviae prov. Yungas (Rusby, no. 330a in Herb. Columbia University).

4. P. lanceolatum R. et Pav. Fl. Per. **1**: 36. *pl. 61, f. b.*

Unduavi in Bolivia, alt. 8,000 ped. (Rusby, no. 2178 in Herb. Boiss.).

5. P. psilophyllum C. DC. Bull. Torr. Bot. Club, **19**: 47. 1892.

Limbi apice acuminati in sicco pallide virescentes et subglaucescentes.

In Bolivia (Rusby, no. 2900 in Herb. Cand.).

6. P. trichorhachis, foliis breviter petiolatis glabris oblongo-ellipticis basi leviter inaequali acutis apice acuminatis, nervo centrali ex ½–⅓ longitudinis nervos adscendentes utrinque 5 mittente petiolo basi ima vaginante, pedunculo glabro petiolum 2–3plo-superante, amento quam folii limbus breviore floribus spiraliter insertis rhachi hirsuta, bracteae vertice lunulato carnoso margine praesertim antice hirsuto pedicello utrinque hirsuto, bacca subtetragona ad rhachin elongata glabraque.

In Boliviae prov. Yungas, Decembri (Weddel, no. 4264 in Herb. Mus. Par.).

Ramuli glabri laeves, amentiferi circiter 2 mm. crassi. Collenchymatis fasciculi discreti in sectione transversali transverse elongati et zona interna parce libriformes, fasciculi intramedullares 1-seriati. Limbi in sicco coriacei nitidi opaci pallescentes parce fusco-punctulati, circiter 13 cm. longi, 5 cm. lati. Petioli circiter 6 mm. longi. Amenta submatura 3 mm. crassa, fere 7 cm. longa. Stamina 4. Stigmata 3, sessilia, brevia.

7. P. TRIGONIASTRIFOLIUM, foliis brevissime petiolatis lanceolatis basi leviter inaequali acutis apice longiuscule acuminatis utrinque glabris, nervo centrali vix ad ½ longitudinis suae nervos alternos adscendentes utrinque 4–5 mittente, petiolo basi ima vaginante, pedunculo petiolum aequante glabro, amento quam folium dimidio breviore apice subacuto, bracteae vertice truncato triangulari margine pedicelloque lato hirsutis, bacca subtetragona vertice hirsuta, rhachi hirtella.

In Bolivia (Bang, no. 2197 in Herb. Cand.).

Ramuli glabri laeves, amentiferi 2.5 mm. crassi, collenchymatis fasciculi discreti zona interna libriforme, fasciculi intramedullares 1-seriati. Limbi in sicco coriacei opaci pellucido-punctulati glaucescentes ad 14 cm. longi et ad 5 cm. lati. Petioli vix 5 mm. longi. Amenta fere matura, circiter 5 mm. crassa. Stamina 4, stigmata 3 sessilia linearia.

8. P. BOLIVIANUM C. DC. Prodr. **16**^{1}: 280.

In Boliviae prov. Yungas (Rusby, no. 540 in Herb. Columbia University).

9. P. RUSBYI C. DC. Bull. Torr. Bot. Club, **19**: 47. 1892.

In Boliviae prov. Yungas (Weddel, no. 2296 in Herb. Mus. Par.).

10. P. GAUDICHAUDIANUM Kunth, Linnaea, **13**: 639. 1839.

In Prov. Yungas (Rusby, no. 345 in Herb. Boiss.).

11. P. ACUTIFOLIUM R. et. Pav. Fl. Per. **1**: 38. *pl. 64, f. a.*

In prov. Yungas (Rusby, no. 215 in Herb. Boiss.).

12. P. OBLIQUUM R. et Pav. Fl. Per. **1**: 37. *pl. 63. f. a.*

Ad Mapiri (Rusby, no. 2174 in Herb. Boiss.).

13. P. BLANCHETII C. DC. Prodr. **16**^{1}: 318.

Ad confluentem fluminum Beni et Madre de Dios (Rusby, no. 2183 in Herb. Boiss.).

Sectio 4. Carpunya C. DC. **16**^{1}: 326.

14. P. PAULOWNIFOLIUM C. DC. (in Durand et Pitt. Primit.).

In Bolivia (Rusby, no. 2640 in Herb. Columbia University).

Sectio 5. Potomorphe C. DC. Prodr. **16**^{1}: 331.

15. P. UMBELLATUM Willd. Sp. Pl. **1**: 166.
Ad Mapiri (Rusby, no. 2173 in Herb. Boiss.).

16. P. PELTATUM L. Sp. Pl. 42. 1762.
In Bolivia (Bang, no. 1607 in Herb. Boiss.).

PEPEROMIA R. et Pav.

A. Amenta in apice caulis paniculatim disposita.

1. P. VESTITA, foliis longiuscule petiolatis oblongo-ellipticis basi acutis apice obtusis utrinque dense tomentosis, nervo centrali nervos adscendentes utrinque 4–5 mittente, amentis in apice caulis paniculatim dispositis ipsis quam folia brevioribus et brevissime pedunculatis, bractea orbiculari, ovario emerso ovato basi breviter angustato apice longiuscule et oblique rostrato sub rostro antice stigmatifero.

In Bolivia (Bang, no. 2645 in Herb. Columbia University).

Herba ut videtur erecta caule dense tomentoso. Limbi in sicco membranacei crebre pellucido-punctati ad 10.5 cm. longi et ad 4.5 cm. lati. Petioli fere 3 cm. longi, dense tomentosi. Panicula tomentosa ramosa circiter 20 cm. longa, ramis subverticillatim amentiferis. Amenta filiformia fere ad 7 cm. longa et densiflora, squamis oblongis (?) cito caducis fulta. Antherae rotundatae quam filamenta breviores. Stigma globosum minute papillosulum.

B. Amenta in foliorum axillis solitaria aut terminalia aut apice ramuli geminata.

§ 1. *Ovarium apice stiliferum aut saltem sub stigmate distincte attenuatum.*

2. P. PARVIFOLIA C. DC. Seem. Journ. **4**: 133. 1866.
In Bolivia (Rusby, no. 1860 in Herb. Columbia University).

3. P. UMBILICATA R. et Pav. Fl. Per. **1**: 30. *pl. 45. f. b.*
α macrophylla C. DC. in Prodr. **16**^{1}: 394.
In Bolivia (Rusby, no. 2448 in Herb. Columbia University).

4. P. MANDONII C DC. *l. c.*, 395.
Ibid. (Rusby, no. 1719 in Herb. Columbia University).

5. P. BRITTONII C. DC. Bull. Torr. Bot. Club, **19**: 254. 1892.
Post: *foliis ternis*, adde: *ovatis.*

§ 2. *Ovarium neque stiliferum neque sub stigmate attenuatum.*

**Folia alterna.*

† *Ovarium stigma in apice summo aut paullo infra apicem et oblique gerens.*

6. P. TALINIFOLIA Kunth, H.B.K. Nov. Gen. **1**: *62. pl. 8.*

In prov. Yungas (Rusby, no. 330 in Herb. Boiss.).

7. P. SORATANA, foliis longiuscule petiolatis adultis oblongo-lanceolatis supra ad nervos et subtus ubique pilosulis 5-nerviis, amentis longiuscule pedunculatis axillaribus terminalibusque filiformibus adultis folia parum superantibus, bractea orbiculari ovario emerso obovato apice obtuso et oblique stigmatifero.

In provincia Larecaja viciniis Sorata Quiliguaya ad rivum in nemoribus, alt. 2800 m. Septembri (Mandon, no. 1115 in Herb. Mus. Par.).

Herba erecta (?) caule pilosulo inferne radicante in sicco complanato et ad 6 mm. crasso. Limbi ad 9 cm. longi et ad 2.5 cm. lati in sicco membranacei pellucido-punctulati. Petioli 2.5 cm. longi. Amenta densiflora. Bractea et ovarium in sicco fusco-punctulata. Stigma carnosum et glabrum.

8. P. ADENOCARPA, foliis modice petiolatis ellipticis basi ima subacutis apice obtusis utrinque subdense pilosis 3-nerviis, amentis axillaribus terminalibusque, folia parum superantibus filiformibus, bractea orbiculari, bacca emersa rotundato-ovata in sicco glandulis rugulosa et apice oblique rostellata.

In provincia Larecaja viciniis Sorata Quiliguaya ad rivum in umbrosis, alt. 2700 m., Aprilli (Mandon, no. 1116 in Herb. Mus. Par.).

Herba caule e basi radicante erecto et simplici 25 cm. longoi dense pilosulo in sicco filiformi, internodiis fere 1 cm. longis. Limbi 2–3.5 cm. longi et 1.5 cm. lati in sicco tenuiter membranace, et pellucidi. Petioli ad 7 mm. longi, pilosuli. Amenta subdensiflora. Bacca 1 mm. paullo superans.

9. P. DUMETICOLA, foliis modice petiolatis subdensis ovatis utrinque obtusis supra ad nervos et subtus ubique et subdense pilosis fusco-punctulatisque 5-nerviis, amentis axillaribus terminalibusque modice pedunculatis ipsis filiformibus et folia vix duplo superantibus, bractea orbiculari fusco-punctulata, ovario rhachi subimpresso oblongo apice obtuso et oblique stigmatifero.

In provincia Larecaja, viciniis Ananea cerro de Tuiki in dumetosis, alt. 3150 m., Maio (Mandon, no. 1117 in Herb. Mus. Par.).

Herba erecta, caulibus ramulosis in sicco coriaceis circiter 4 mm. crassis et junioribus dense pilosis, internodiis circiter 6 mm. longis. Limbi ad 3.5 cm. longi et ad 22 mm. lati, in sicco firmi et opaci. Petioli 5 mm. longi pedunculique eis paulo longiores hirtelli. Amenta in sicco fusco-punctulata densiflora. Stigma carnosum puberulumque.

10. P. BREVISPICA, foliis supra adpresse puberulis subtus glabris et fusco-punctulatis inferioribus majoribus longe petiolatis e basi cuneata obovato-ellipticis apice obtusis 7-plinervis superioribus gradatim minoribus, amentis in apice ramulorum axillaribus terminalibusque quam folia inferiora pluries brevioribus longiuscule pedunculatis et densifloris, bractea orbiculari, ovario emerso obovato sub apice oblique stigmatifero.

Bang, no. 2641.

Herba erecta ramulosa, ramulis glabris coriaceis. Limbi in sicco rigido-membranacei subpellucidi crebre pellucido-punctulati foliorum inferiorum 4 cm. longi et 27 mm. lati cum petiolis 2 cm. longi, superiorum multo minores an adulti? Pedunculi 5 mm. longi. Amenta 9 mm. longa. Antherae ellipticae quam filamenta paullo breviores. Stigma papillosulum.

†† *Ovarium apice oblique complanatum et scutatim auctum, antice stigmatiferum. Bacca oblique rostrata.*

11. P. PELTIFOLIA, foliis magnis longe petiolatis ample ovatis fere ad 4 cm. supra basin peltatis basi rotundatis vel leviter repandis apice breviter acuminatis supra sat dense et adgresse pilosis subtus densissime villosis, nervo centrali fere ad ⅔ longitudinis nervos utrinque 5 adscendentes supra basin et 2–3 e basi divaricantes mittente, amentis in apice caulis oppositifoliis quam folia brevioribus, pedunculis quam petioli brevioribus et dense villosis, rhachi adulta dense villosa, bractea orbiculari, ovario emerso ovato apice oblique rostrato et antice complanato sub rostro stigma carnosum gerente.

In Bolivia (Rusby, sine numero in Herb. Columbia University).

Caulis dense villosus circiter 6 mm. crassus. Limbi in sicco membranacei, circiter 24.5 cm. longi et 14.5 cm. lati. Petioli ad 11 cm. longi. Pedunculi adulti circiter 3 cm. longi. Amenta ut videtur adulta 6–7 cm. longa et 6 mm. crassa.

12. P. COBANA C. DC. Bot. Gaz. **19**: 260. 1894.

In Bolivia (Rusby, sine num. in Herb. Columbia University).

** *Folia opposita.*

13. P. CIRCINATA Link, Jahrb. **1**^{3}: 64. 1820.

Ad confluentem fluminum Beni et Madre de Dios (Rusby, no. 2208 in Herb. Columbia University).

14. P. BLANDA Kunth, H.B.K. Nov. Gen. **1**: 67.

In Bolivia (Rusby, no. 1819^b in Herb. Columbia University).

*** *Folia verticillata.*

15. P. MULTISPICA, foliis 4–3-verticillatis brevissime petiolatis utrinque hirtellis margineque ciliatis e basi acuta inferioribus minoribus obovatis superioribus vero lanceolatis 3-nerviis, amentis axillaribus terminalibusque in apice caulis numerosis et filiformibus folia fere 4-plo superantibus longiuscule pedunculatis, bractea orbiculari, ovario emerso apice oblique stigmatifero, bacca subglobosa laevi et glabra.

In Bolivia (Rusby, no. 331 in Herb. Cand.; Bang, no. 2639 in Herb. Columbia University).

Erecta inferne radicans, circiter 20 cm. alta, caule dense hirsuto in sicco 3 mm. crasso. Limbi superiores ad 22 mm. longi vix 1 cm. lati. Petioli ad 2.5 mm. longi. Amenta haud densiflora. Stigma minutum.

Species *P. camptotrichae* Miq. proxima.

16. P. SAXICOLA, foliis 3–5-verticillatis brevissime petiolatis superioribus ellipticis basi acutis apice obtusiusculis utrinque adpresse et dense pilosulis 3-nerviis, amentis axillaribus terminalibusque pedunculatis, filiformibus folia parum superantibus, bractea rotundato-elliptica, ovario emerso obovato glandulis consperso apice stigma minutum glabrum oblique gerente, bacca elliptica laevi apice brevissime oblique acutata.

17. P. STUBELII C. DC. Bull. Torr. Bot. Club, **19**: 255. 1892.

Tunari (Otto Kuntze), San Pedro in rupibus (Herb. Mus. Par.).

18. P. INAEQUALIFOLIA R. et Pav. Fl. Per. **1**: 30. *pl. 46, a.*

In provincia Larecaja, alt., 269 m., Augusto (Mandon, no. 1120 *bis* in Herb. Mus. Par.).

19. P. GALIOIDES Kunth, H.B.K. Nov. Gen. **1**: 71.

In provincia Larecaja, viciniis Sorata, carro del Iminapi in umbrosis (Mandon, no. 1119 in Herb. Mus. Par.).

In provincia Larecaja viciniis Sorata prope Challapampa in petrosis, Decembri (Mandon, no. 1118 in Herb. Mus. Par.).

Herba caule dense et depresse pilosulo inferne radicante superne ramuloso, in sicco circiter 4 mm. crasso. Folia inferiora obovata, superiorum limbi in sicco membranacei subopaci ad 2 cm. longi et 7 mm. lati. Petioli vix 2 mm. longi. Pedunculi pilosuli circiter 12 mm. longi.

20. P. ACEROANA, glabra foliis plerumque 4-verticillatis breviter petiolatis e basi acuta oblongo-obovatis vel oblongo-ellipticis in sicco subcoriaceis, amentis terminalibus longe pedunculatis ipsis folia circiter duplo superantibus filiformibus densifloris, bractea orbiculari, ovario emerso oblongo, summo apice stigma carnosum glabrum gerente.

In provincïa Acero, Novembri et Decembri (Weddel, no. 3615 in Herb. Mus. Par.).

Herba repens, ramuli erecti cum amentis circiter 6 cm. longi in sicco coriacei 1 mm. crassi. Petioli vix 3 mm. longi. Pedunculi circiter 3 cm. longi.

Species rhachi glabra a *P. reflexa* Diet. ovariis haud immersis limbis angustioribus ramulisque glabris a *P. Boliviensi* C. DC. discrepans.

21. P. TOMINANA, foliis parvis plerumque quaternis brevissime petiolatis ellipticis basi et apice obtusis utrinque glabris apice ciliolatis, nervis inconspicuis, amentis terminalibus longiuscule pedunculatis ipsis folia circiter duplo superantibus densifloris et filiformibus, rhachi hirtella, bractea orbiculari, ovario emerso oblongo summo apice stigma carnosum et glabrum gerente.

In prov. Tomina, Depart. Chuquisata, Decembri (Weddel, no. 3109 in Herb. Mus. Par.).

Herba e basi radicante ramulis hirtellis 4–5 cm. longis in sicco coriaceis 1 mm. crassis. Limbi in sicco coriacei subpellucidi adspectu enervii 6 mm. longi. Petioli 1 mm. longi. Pedunculi hirtelli circiter 1 cm. longi. Amenta florentia circiter 12 mm. longa.

Species *P. reflexae* Diet. proxima foliis multo minoribus ovarioque emerso ab ea discrepans.

22. P. PSILOSTACHYA C. DC. Mem. Soc. Phys. **32**: *pl. 54. f. 6.*

In prov. Yungas, alt. 6000 ped. (Rusby, no. 2210 in Herb. Columbia University).

23. P. REFLEXA Diet. Sp. **1**: 180.

In prov. Yungas, alt. 6000 ped. (Rusby, no. 2203 in Herb. Columbia University).

Starch Distribution as affected by Fungi.*

By Byron D. Halsted.

A study of the distribution of starch in variegated leaves led to a consideration of the presence of this carbohydrate in leaves that were more or less affected with parasitic fungi. Thus, from the variegated *Abutilon* and *Ficus* leaves it was an easy step to those that were mottled by the presence of fungi.

The treatment consisted in immersing the leaves in weak alcohol in glass vessels which stood in the full light of the sun.

The time required for the removal of the chlorophyll depends much upon the thickness and density of the leaf and whether it was freshly gathered or a dried specimen. Usually two or three days are sufficient for the blanching of the leaf when it is ready to be placed in a weak solution of iodine made by adding an ounce of the ordinary solution of iodine in iodide of potassium to a pint of water.

After remaining for a few hours there may be some changes expected, the thinner the leaf the more rapid the reaction. The starch in the leaf responds to the iodine test and, turning blue, brings out the locality where the starch is present in the leaf.

The first subject to be tested chanced to be some dried leaflets of *Potentilla Monspeliensis* affected with the *Peronospora potentillae* DeBy., which, somewhat to my surprise, became quite distinctly blue at the areas where the fungus was bearing its conidia.

This fungus produces angular patches of a brownish color, easily seen from the upper side, while below the surface of the spots become covered with the conidiophores and conidia of the fungus giving this side of the leaf a mildewy appearance in small patches with irregular outlines.

In this instance the leaflets were first placed in 50 per cent. alcohol in a large culture jar with glass cover and set in the sun. After the green has been removed the leaves were transferred to another culture jar containing the iodine and kept in the dark.

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* Read before Section G, A. A. A. S., at Boston, August 23, 1898.

In the course of twenty-four hours the portion of the bleached leaflets containing starch were indicated by a darker tinge than elsewhere. A longer exposure to the iodine brought out the starch so that it was located distinctly, and it was found that, with the specimens employed, the starch was confined almost exclusively to the mildewed patches and the neighboring small angular areas that adjoin the portions that already showed the *Peronospora.*

The darkening at these diseased patches was sufficient so that a sun print was taken of a leaflet and afterwards enlarged to five times its natural size, as was shown in a photograph. The original picture was made by placing the leaf directly against the sensitized plate so that every detail is exactly as in the leaf, both as to size and position of all parts.

It is to be remembered that the blanching was not complete, and the iodine, while coloring the starch blue, also tinged the other portions of the tissue of that peculiar "dirty yellow" that is always the bane of the photographer. In short, the picture in this instance, as in all others, is only a faint record of what may be seen when looking at the treated specimen.

One of the most interesting of the observations made under the subject in hand was with *Synchytrium decipiens* Farl. in the leaves of hog-peanut, *Falcata comosa* (L.) Kuntze.

It will be remembered that the Chytridiaceae to which our subject belongs is without hyphae and, therefore, the locality of the fungus is easily determined by that of the infested cells. The leaflets of this host are thin and the iodine easily penetrates the tissue and for the same reason the starch, even when in small amounts, can be distinctly seen.

In the dozen or so of leaves examined it was found that the starch is located immediately around the spore cysts and extends from it through usually one mesh or irregular area made by the ultimate ramifications of the vascular framework. As a matter of fact the fungus is generally located along the lateral veins of the leaf and these are brought out as irregular blue lines when the leaves have been subjected to the iodine test. When a leaflet is quite badly diseased with the *Synchytrium* it will take a blue color throughout all its tissues.

A leaf of *Amarantus retroflexus* L., having seven large circular patches of *Cystopus bliti* (Biv.) each nearly a third of an inch in diameter was placed in the iodine solution without the previous bleaching, when, after a week, it was found that practically no starch was in the pustular portion, but close around the diseased area was a deep blue circle. All the healthy portion of the leaf contained starch in considerable quantity, but the large amounts in the tissue immediately bordering the portion bearing the conidia of the fungus were in striking contrast with all other parts.

The most striking subject among the leaf parasites is the mandrake leaf infested with *Puccinia podophylli* Schw. It is interesting for the very large amounts of starch that are located in the infested areas, and also for the sharp line of demarcation between the diseased and the healthy portions of the leaf. In other words the *Puccinia* seems to find the ultimate ramifications of the vascular system a complete barrier to its lateral growth, and it seems that the infection in many instances is local and does not reach beyond the angular boundaries made by the smaller veins. The same lines become the enclosures for the starch-bearing areas.

It will also be seen here that the infested areas bear some relationship to the main veins in this, that one side at least of nearly every infested area is against a vein of considerable size, a subject that is a study in itself.

Another fact is noticed in the mandrake, namely, that as a rule there is less starch in the center of the rusted mesh than nearer the periphery.

One of the most striking instances of starch localization is found in the leaves of ordinary corn that are infested with the smut (*Ustilago maydis* DC.). Pieces of leaves that were more or less distorted by nodules and projections of the smut-bearing tissue that had been in alcohol for a year as material for class study of the smut were placed in the iodine, when the blue color began almost immediately to appear in the swollen tissue. All of the bullate portions of the leaves due to the infestation of the fungus finally became of a strong blue color.

A study of the subject with the hand lens showed that, while there was an abundance of starch in the warts, around each center there was a very small space free from starch followed by the ordinary leaf tissue strongly discolored by the iodine. It was also seen with the lens that the blue color was not uniformly distributed, but in very narrow lines running parallel with the midrib and corresponding with the smaller vascular strands in the leaf.

If we turn now from the consideration of leaves infested with fungi to stems that are similarly attacked the same rule obtains. For example, some hypertrophied flower stalks of cultivated radish that were in stock in formalin as student's material were thinly sectioned and placed in a weak solution of iodine, when, within a minute, the characteristic bluish tinge came into the sections. Similar thin sections were made of the same stems, but at places where no swelling or distortion had taken place and these showed but the smallest amount of starch and that was usually in a single ring of cells located just outside of the bast. As the bast is not continuous the starch-bearing sheath so-to-say was likewise irregular and bent inward at the intervals between the bast stands. There was practically no starch inside of this thin layer, but a small amount outside of it.

In the infested stems the starch is very abundant and in largest amounts in the parenchyma, lying between the wedge-shaped bundles and extending from them throughout the pith. Beside this there is the starch-bearing layer above mentioned, but outside of it there is no starch. The distribution of the oöspores does not seem to bear any relation to that of the starch.

A similar condition of things was met with in the hypertrophied stems (*Exoascus* sp.) of the wild goose plum (*Prunus hortulana* Bailey) when compared with the normal parts of the same twigs.

The galls of the peach roots are simply gorged with starch, and thin sections of them turn to a dark blue color. This color may be brought out by cutting the knot through the middle and shaving the surface smooth and applying iodine. Certain irregular layers and folds will be darker than others, showing that the starch is distributed most abundantly around the wood proper and not in it.

An interesting study in this direction was made of the cedar galls of *Gymnosporangium macropus* Lk., where the starch is packed away in the enlarged host cells to their utmost capacity, and thin sections through the centers of large galls display a neat fan-shaped appearance after they have been in iodine for a few minutes. The ordinary wood of the gall-bearing twigs show with the same treatment only a small amount of starch, not enough to appear even bluish to the eye after being treated with iodine.

There are certain species of fungi that cause an upright growth of the host when normally the stems are prostrate or reclined. The purslane plants affected with *Cystopus portulacae* (DC.) are a case in point. An examination has been made of the upright, usually dwarfed and badly infested stems of the *Portulaca oleracea* as compared with similar portions of the healthy and prostrate branches. In the latter it is noted that there is much more pink coloring in the sap of the epidermal cells of the upper than the lower side and a larger amount of chlorophyll in the exposed than in the shaded half of the stems as they lie upon the ground. The wood zone is much nearer the outside upon the upper than the lower half of the stem, but there seems to be no marked difference in the wood zone itself, which is circular or oval in outline, consisting of a broken ring of 15 to 20 vascular bundles.

In the healthy stem, while the starch is scattered somewhat, it is confined quite closely to a thin layer of small cells just outside of the ring of wood. The upright mildewed stems have less chlorophyll present, but aside from this the most noticeable difference is the fact that the starch zone is indistinct, the granules being distributed in the cells of the parenchyma both within and outside the starch-bearing sheath so distinctly differentiated in the healthy stem.

In sections made of turnips suffering from the club root fungus, *Plasmodiophora brassicae* Wor., it was quickly observed that the diseased portions were quite generally starch-bearing. Thin sections treated with iodine demonstrated to the eye and the compound microscope that the main portion of the starch is contained in the cells infested with the slime mould. Sections of the same turnip taken in its healthy portions showed but a minimum of starch and this is located in the cells of the cortex. In short, where large slices of the healthy and diseased tissue were laid in weak iodine in a porcelain dish the former showed little or no starch, while the diseased portions appeared almost black.

Thin sections of the large tubercles formed by *Rhizobium* *leguminosarum* Fk., were laid in the iodine solution along with those from the roots near by and bearing the galls. The tissue of the tubercles turned blue almost immediately, while the slices of the roots themselves gave only the faintest indications of starch. The tubercle has a layer of loose cellular tissue as a covering inside of which is the denser substance abounding in the bacterioids. It is this covering that is gorged with starch and from it and reaching in towards the center of the gall are irregular anastomosing broad lines, also containing starch.

Plants that are victims to parasitic fungi may possibly be influenced as if they were wounded. Richards, in his extended experiments upon the respiration of wounded plants,* has concluded that there is an increased respiration after an injury to plant tissue, varying in amount and duration with the character of tissue and extent of wound. "This increased respiration," to quote Dr. Richards' words, "may be ascribed to an effort on the part of the plant to recover from the injury by which the ordinary functions of the plants are stimulated, thereby demanding and necessitating an increased supply of oxygen." Bohn, † referred to by Richards, "concludes there is no doubt that the cause of it (respiration) is alone the irritation of the wound itself and not the increased opportunity for the action of the oxygen of the air." But Richards' experiments and those of Stich, whose paper in Flora has not been consulted, show "that the oxygen of the air plays an important part in the reaction of the respiratory function of the plant toward injury."

Townsend ‡ in his extensive studies states that slight injuries accelerate the rate of growth and will continue for several days. He states, "The change in the rate of growth of higher plants under the influence of a single irritation begins gradually, reaches its maximum in from twelve to ninety-six hours and gradually diminishes until the normal rate is resumed." Also "The influence of an irritation due to cutting or other injury is capable of acting through a distance of several hundred millimeters."

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* Annals of Botany, **10**: 531–582. D. 1896.

† Ueber die Respiration der Kartoffel. Bot. Zeitung, **45**: 671. 1887.

‡ The Correlation of Growth under the Influence of Injuries. Annals of Botany, **11**: 509–532. D. 1897.

It is not the purpose, however, of this paper to do more than call attention to the distribution of starch as affected by parasitic fungi. The infesting fungus induces a change in the surrounding tissue, more or less apparent, with the storage therein of food material as shown by the starch test and demonstrated in the instances noted above.

RUTGERS COLLEGE.

New and interesting Plants from Western North America.—III.*

BY A. A. HELLER.

SALIX LYALLII (Sargent)

Salix lasiandra, var. *Lyallii* Sargent, Gard. & Forest **8**: 463. 1895.

This species is abundant in the low ground along the Chehalis river, in Chehalis county, Wash. I have collected what is said to be *Salix lasiandra* near Lewiston, Idaho, and the variety *caudata* at the original station near Santa Fé, New Mexico, and this western Washington plant is very different from both. As described in the "Silva," it certainly has sufficient characters to make it worthy of specific rank, for it is said to differ in its "longer leaves, tapering from the rounded or subcordate base, usually white on the lower surface, and often seven or eight inches in length, in its more glandular petioles, and the rather narrower and less hairy scales of the pistillate aments."

CORYLUS CALIFORNICA (A. DC.)

Corylus rostrata β Californica A. DC. Prodr. **16**^{2}: 133. 1864.

This differs from the eastern *Corylus rostrata* in its shorter, rounder, thinner, and more pubescent leaves. The tube of the involucre is also much shorter and broader, sometimes barely exceeding the nut. It is abundant in grassy clearings about Montesano, Chehalis county, Washington, occurring as a shrub four to six feet in height, and growing in clumps.

RANUNCULUS INTERMEDIUS (Hook.)

Ranunculus Flammula β intermedia Hook. Fl. Bor. Am. **1**: 11. 1830.

Hooker describes this as "caule repente gracili foliis anguste lanceolatis superioribus linearibus integerrimus. * * On the gravelly banks of rivers from Canada to lat. 69°." This is one of several varieties described by him, but he says that none of them appear to grow west of the Rocky mountains. As now interpreted, this form occurs also on the Pacific slope, but the west coast forms are more robust than the eastern specimens. In his "Flora of Northwest America," Mr. Howell takes for this plant the name *R. Unalaschensis* Bess., published in 1842, founded upon specimens from Alaska, but cites Hooker's name as a synonym. I have seen no Alaskan specimens, and there is a possibility that the eastern and western forms may prove distinct.

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*Substituted for the improper title : "New Plants from Western North America."

Our specimens were collected near Montesano, Washington, June 11, 1898. The plant is plentiful in wet places, the decumbent and creeping stems often two feet long, the lower leaves over a half inch in width.

OPULASTER PAUCIFLORUS (Nutt.)

Spiraea pauciflora Nutt.; T. & G., Fl. N. A. **1**: 414. 1840.

Spiraea opulifolia γ *pauciflora* T. & G., Fl. N. A. **1**: 414. 1840.

Neillia malvacea Greene, Pittonia, **2**: 30. 1889.

Opulaster malvaceus Kuntze, Rev. Gen. Pl. 949. 1891.

Nuttall's type, which is in the herbarium of Columbia University, was collected in "glades of the Blue Mts., Columbia." It is abundant on the Craig mountain plateau, Idaho, which is separated from the Blue mountains by the Snake river, also on the Palouse hills on the north side of the Clearwater, and across the country along the mountains to Lake Pend d'Oreille, where Professor Greene collected his type of *Neillia malvacea.* It is apparently the only *Opulaster* in that region, as its near relative *O. monogynus* has not been detected outside of the Rocky Mountains, and *O. capitatus* appears to be restricted to the western side of the Cascades.

KALMIA MICROPHYLLA (Hook.)

Kalmia glauca γ *microphylla* Hook. Fl. Bor. Am. **2**: 41. 1834.

The original of this was collected in "swamps in the Rocky Mountains, *Drummond,*" and is described as having "foliis vix semipollicaribus subovalibus." I have seen a number of specimens of this from the Rocky Mountains, and consider them entirely distinct from *Kalmia glauca,* with its narrower, longer and thicker leaves.

STACHYS PUBENS (A. Gray)

Stachys ciliata, var. *pubens* A. Gray, Syn. Fl. N. A. **2**^{1}: 388. 1878.

This is described as having "flowers commonly rather smaller or shorter" than those of *S. ciliata.* Our specimens, collected at Montesano, Washington, have flowers much larger, and red-purple in color, as compared with the pink flowers of *S. ciliata,* which is also plentiful at the same place. The plant in the Columbia herbarium, collected by Holmes on the Fraser river, and cited as the type of the variety, is imperfect, and the flower appears to be rather small. This appearance, however, is probably due to insufficient pressure, for in other respects our plant is similar, as are specimens collected by Macoun in British Columbia. In addition to the larger, darker colored flowers, this species is much stouter than *S. ciliaris,* blooms two weeks later, has narrower leaves in proportion to their length, with sharper crenations, and the inflorescence is longer, with shorter and narrower floral leaves.

HYDROPHYLLUM TENUIPES sp. nov.

Stems erect, rather stout, about 5 dm. high, branching, purplish, especially below, channeled, sparingly covered with spreading, clear colored hairs : leaves broadly ovate in outline, the larger lower ones about 10 cm. in length by 15 cm. in width, lower and basal ones long-stalked, pinnately 3–5-parted, the lobes obovate, and laciniately toothed or cut, the teeth acute, mucronate ; both sides more or less provided with hairs of the same character as those of the stem, but appressed ; the under side also slightly whitened : cymes on stalks about 8 cm. in length, simple or forked, the flowers borne on slender pedicels .5–1.5 cm. in length, which are beset with the same kind of hairs which are on the other parts of the plant : calyx 7–8 mm. long, the lobes erect, narrowly linear-lanceolate, hispid-ciliate with the same clear spine-like hairs : flowers creamy, or faintly tinged with purple, the corolla-lobes almost oval in outline, a little longer than the calyx, slightly notched, with an oblong appendage half as long as the lobe attached to the inner face of each : stamens long-exserted, as in the genus : ovary hispid.

The type is our no. 3853, collected at Montesano, Chehalis county, Washington, May 31, 1898. The plants grew in low, moist, rich ground, along the Chehalis river, in a place which later in the season becomes overgrown with grass, small bushes, and various herbaceous species. *Hydrophyllum tenuipes* belongs to the medley called *Hydrophyllum occidentale,* but differs from typical plants of that species by its acute leaf-segments, possibly taller growth, and the totally different character of its pubescence.

411 W. WALNUT STREET, LANCASTER, PA.

Cordyceps stylophora Berk. & Br. in Minnesota.

On the 28th of April, 1898, I found a single specimen of this rare American species growing upon the larva of a carabid beetle among *Hypnum* at Minnehaha Falls near Minneapolis. The plant was originally described from specimens of Ravenel collected in South Carolina and was distributed by Ravenel in Fung. Car. Exsic. **5**: no. 49. It is figured in Berkeley's paper,* but the ripe asci were not seen by the authors. Another figure of the plant is given by Massee † in his monograph of the genus, and in this paper the first measurements of asci and spores are recorded from the type specimen in the Kew Herbarium. I do not find that the Minnesota plant conforms exactly to these measurements. According to Massee the spores are 125–135 × 1 μ and the component cells "about 3.5 μ long." The Minnesota plant shows spores 150–180 × 2 μ with component cells 6–7 μ long. In all other respects the plant found at Minnehaha agrees quite exactly with the descriptions and figures. In Saccardo ‡ and Ellis § no microscopic measurements are given. This new discovery is apparently indicative of a comparatively wide range for the species.

Conway MacMillan.

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§ Ellis and Everhardt. N. Am. Pyren. 61. 1892.

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OF THE

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BULLETIN

OF THE

TORREY BOTANICAL CLUB

DECEMBER 1898

Revision of the Bermuda Ferns.

BY BENJAMIN D. GILBERT.

The two chief authorities on Bermuda ferns are Governor J. H. Lefroy, whose list of Bermuda plants was published by The Smithsonian Institute in its Bulletin No. 25, in 1884; and the botanical volume of The Challenger Expedition, published by the British government in 1885, the material for which was collected between 1873 and 1877, and was determined by Mr. W. B. Hemsley. Another small volume, entitled "Plants of the Bermudas," by Oswald A. Reade, was also published at Hamilton, Bermuda, in 1885. It is very imperfect in its list of Filices, but is entitled to recognition on account of one species given in it, which neither of the other works mentions.

It should be remembered that the Bermudas are not tropical islands and that the fern flora is small in comparison with that of the West Indies. For instance, the ferns comprise more than one fifth of the flowering plants and vascular cryptogams growing in Jamaica, while in Bermuda they form only about one fourteenth part of the whole number. There is neither sufficient moisture nor sufficient heat to promote their growth. At the same time there are some very good and desirable species. Only one fern, however, is generally distributed throughout the islands: all the others being confined principally to two kinds of localities having distinct characteristics of their own. These localities are what are known, first, as "the marshes," and second, as "the caves."

The marshes are hardly what we would call swamps. They are large, level plats at the foot of hills or between them, where some

[Issued 16 December.]

water collects in a rainy period, but which can always be traversed on foot except for a sluice way, perhaps eight to ten feet broad, which apparently has no current and no outlet, and which is often completely covered with duckweed (*Lemna minor*). On the margins of these dark sluggish waters grow large numbers of dog-bush (*Baccharis heterophylla*), while in the marshes themselves grow the omnipresent juniper, occasional large specimens of the palmetto (*Sabal Palmetto*), several species of Cyperaceous plants and quantities of ferns belonging to five or six species only.

There are two kinds of so-called "caves" in Bermuda. Several of them are genuine caves, and there the ferns grow, not inside the caves, but on the rocks and debris about their entrances. The other caves are simply holes in the earth, open to sun, air and rain, sometimes twelve to fifteen feet across at the top and as many feet deep; sometimes 150 feet across and sixty to seventy-five feet deep. Geologists say that all these were once genuine caves, the roofs of which became too heavy to hold themselves up and fell into the interior, carrying with them whatever vegetation had grown on the surface. Darwin, in his "Voyage of a Naturalist," tells us that at the Galapagos Islands also "the tops of caverns have fallen in, leaving circular pits with steep sides." These caves are shady; they retain moisture longer than the upper surface; they are protected from the severe winds; and as a consequence they are the haunts of the rarest and choicest ferns of the islands. The descent into these cavities is always steep, sometimes precipitous. They occur chiefly in what is known as "the Walsingham tract," a peninsula lying between Harrington sound on the west and Castle Harbor on the east, about three miles in length and one to two miles in width. It takes its name from the former residence of Tom Moore, the Irish poet, who was appointed to a government office in Bermuda and lived there for about six months, but was too fond of the gaieties of London life to remain longer.

As there are only twenty-five species and varieties of ferns in Bermuda, I propose to speak of each separately and of the locality in which it grows.

ADIANTUM CAPILLUS-VENERIS L.

None of the authorities credit Bermuda with this species, but it will certainly have to be included, although probably naturalized at a comparatively late date. The last day that I was out collecting in the Walsingham district I came across some fronds that looked quite different from the variety *A. Walsingense*, but I had seen so much of this fern that I supposed these plants were only another form of that variety and consequently gathered only two or three fronds. On returning to America and unpacking my collection, these fronds struck me at once as being larger and more open, with pinnae more deeply cut and more cuneate, than any other *Adianta* in the collection. On consulting Governor Lefroy's list more carefully, it was found that *A. capillus-Veneris* was one of the ferns which he "planted out in promising localities about Paynter's Vale (Walsingham district) with a view to their introduction." In the case of this species his effort was evidently successful, and it may now be counted as one of the naturalized species of the island. Very likely it would have been found in other spots visited, if I had been on the look-out for it.

ADIANTUM BELLUM Moore.

Moore's description of this species was originally published in the Gardener's Chronicle, London, 1879. It was reproduced in the Voyage of H. M. S. Challenger, 1885, but as these publications are to be found only in a few of the larger libraries of this country, and the description is short, it is reprinted here.

"Fronds tufted, 3 to 6 inches high, bipinnate, ovato-lanceolate; pinnae of 3 to 6 pinnules ½ to 1½ inch long; pinnules cuneate or irregularly transverse-oblong, the somewhat larger terminal ones cuneate and divided into two or three shallow lobes, the margin erose, all shortly pedicellate, the pedicels hairlike, not articulated with the pinnule but showing at their apex a short y-shaped ebonous furcation which passes into the flabellate venation; sori various, two or three on the smaller pinnules short and roundish or longer and sublunate, situated at the apex of the shallow lobes; indusium entire; caudex thin, shortly creeping with criniform scales; stipes and rachis ebonous, smooth."

This is the common fern of the islands. It grows everywhere, on exposed rock surfaces that line the roadsides, on garden walls and sometimes but not often in soil. Moore's description should be modified by making the size 3 to 8 inches, the fronds bi-tripinnate and the sori long and broad in comparison with the size of pinnules, of which they nearly cover the entire upper edge. The indusium also is not entire, but especially when young is erosed similar to the edges of the pinnules.

ADIANTUM BELLUM WALSINGENSE var. nov.

Rhizome stout, somewhat woody, repent, sending roots into the crevices of rocks: stipes 5–9 in. long, dark ebonous, shining, furrowed and at base flattened, with a few linear light brown scales; rachis conform, smooth; frond 9–12 in. long, 5–7 in. wide, tri-quadripinnate; pinnae 3–6 in. long, lower opposite, upper alternate, segments ⅜–½ in. long, ¼ in. wide, sometimes cuneate, sometimes almost dimidiate, more often the latter with lower edge straight and entire, upper and outer edge with 2–3 large lobes; sinuses shallow, generally an upper and a side lobe, edges of barren pinnules finely erose with a vein running into each tooth, venation flabellate, very distinct, texture thin, herbaceous: sori straight whether long or short, when only one sorus generally on side lobe; indusium broad and finely erose like edges of pinnules.

This variety is much larger than the species. *A. bellum* as a rule is very fully fruited even on the smallest fronds. *A. Walsingense*, on the contrary, fruits sparingly in comparison with the large number of pinnules, which are generally two-lobed, having an upper and a side lobe. The variety shows a preference for bearing only one sorus which in that case is situated on the side lobe, thus giving the pinnules a one-sided appearance and easily distinguishing the variety.

PTERIS LONGIFOLIA L.

Neither Lefroy nor Hemsley gives this species as native or naturalized in Bermuda, but it is the one species which Reade adds to the list. It is met with quite frequently about the city of Hamilton, growing in the crevices of walls or wherever the wind may have lodged a few spores. The species is well established and is likely to increase rather than diminish.

PTERIS HETEROPHYLLA L.

This fern is found in several of the open caves and on the cliffs of the Walsingham tract. Its local name is "parsley fern," and it has been gathered so much for decoration that it is becoming scarce except in the more inaccessible places. It seems difficult to find it in fruit, but in favorable locations the fronds attain a wonderful size, being sometimes nearly 3 feet in length, when the normal size elsewhere is only 6–12 inches. It is a West Indian and Brazilian species.

PTERIS AQUILINA CAUDATA L.

While this species is abundant in the marshes, it is peculiar in its mode of growth. In Devonshire marsh, where it grows most luxuriantly, it may frequently be seen 10–12 feet high. It seems ambitious to overtop everything near it; so it pushes up through the *Baccharis* bushes and all other undershrubs and ripples over them in shining waves of green, forming one of the most beautiful sights in the island. The fronds are hard, glossy and coriaceous, showing its siliceous character very distinctly. The farmers living in the vicinity go into the marshes and cut quantities of *Fteris* and *Osmunda* as bedding for their animals.

WOODWARDIA VIRGINICA Smith.

Governor Lefroy states that this fern is found only in Pembroke marsh and is not very abundant there. I found it quite plentiful on the north side of Devonshire marsh, where, in its young and unfruited stages it was liable to be confounded with *Osmunda cinnamomea* unless one took pains to notice its different mode of growth, standing in shade where it was sure to get plenty of water, and never with roots raised above the surrounding soil.

ASPLENIUM DENTATUM L.

Frequent on rocks in Walsingham district, covering surfaces 3 or 4 feet square, and sometimes producing fronds 4 to 5 inches long.

ASPLENIUM TRICHOMANES MAJUS Mett.

This fern, which is quite common in Bermuda is nearly identical with the form figured and described by Hooker & Greville in "Icones Filicum" as *Asplenium anceps* Solander, but afterward placed by Hooker in his "Species Filicum" as var. *majus* of *A. Trichomanes*. It is the same form that is found in Madeira and the Azores. To the casual observer it looks quite distinct from the European and North American forms of *A. Trichomanes*, but comparison with a considerable number of specimens shows that the two forms gradually shade into each other. In Bermuda the fronds often measure 12 to 15 inches in length and are fully one inch wide. A peculiar feature of the plant in its native condition is that the pinnae rise like a series of numerous shelves one above another, instead of lying in the same plane with the rachis as in the majority of ferns. The fronds also grow upright, whereas in *A. Trichomanes* proper they spread out more in the form of a rosette.

ASPLENIUM MYRIOPHYLLUM Presl.

Lefroy says that this is "The rarest of Bermuda ferns and is only found about the Church cave." Hemsley quotes Paynter's Vale as a locality, but I could not find it there, although I had a guide who was thoroughly familiar with that part of the island and took me to every spot where ferns were likely to be found. I obtained it at the Church cave, but it is very scarce there and liable to extinction. It exactly agrees with the Jamaica and Florida forms.

ASPLENIUM LAFFANIANUM Baker.

This is another of the endemic species of Bermuda. Governor Lefroy supposed it to be a form of *A. crenulatum* Baker, and published it as such. A plant was sent to Kew for cultivation by Governor Laffan, and proving to be entirely new it was dedicated to him. This also has come to be a very rare fern in the islands. The only specimen I possess came from a plant in the fernery of Mrs. William Bluck, Hamilton, which she obtained at the Church cave some years ago. Mr. and Mrs. Bluck accompanied me to that locality, hoping that we might procure a few specimens; but we were not successful, nor was I able to find it on a later visit to the same cave. Lefroy said it was "found chiefly in the Walsingham tract, and is not very common." Mr. Baker puts it "near *A. crenulatum*," but it seems to come nearer *A. Mildei* Kuhn which was found in the Andes of Equador by Jameson.

DRYOPTERIS ACULEATA (L.) Kuntze.

Neither Lefroy nor Reade mentions this species. Hemsley gives it as growing at "the caves," but without special locality.

Of course he had not visited the islands, but was working on specimens ostensibly collected there. The species is so common and so well known in Europe that there could be no question of error in its determination. The only suggestion might be that, as the Challenger collections were obtained from a large number of islands in different parts of the world, a few fronds of this common fern might by accident have found their way into a collection where they did not belong. I saw nothing of it in Bermuda, but it may be a species that has disappeared from those islands, and being in the Kew collection it must stand as a Bermuda species, at least of a former time.

DRYOPTERIS CAPENSIS (Willd.) Gilbert.

This noble species, which is denominated the "ten-days fern" by Bermudians, because it will keep green ten days after it is cut, grows in the Devonshire marsh, but, as Lefroy says, "it is in danger of extermination, not being abundant." He transferred some plants to Pembroke marsh, but they do not seem to have become established. I found one plant (or "tree," as they call all single plants in Bermuda) of it under a ledge at Paynter's Vale, but that was the only other locality where it was seen.

DRYOPTERIS AMPLA (Mett.) Gilbert.

Mr. Hemsley cites Paynter's Vale for this fern. Governor Lefroy says it is "common by roadsides." There is no reason to doubt that the species grows or has grown in Bermuda, but it is doubtful if it was ever "common." Had it been so I must have seen some trace of it. Most of the species of ferns are in their best estate in March and April, but this species may appear later in the season, which would account for my not finding it. It belongs especially to the West Indies and South America.

DRYOPTERIS PATENS (Sw.) Kuntze.

This fern is, next to *Adiantum bellum*, the most common of any in Bermuda. It grows in both dry and moist ground, but in the marshes it attains its largest size, frequently reaching a height of 4 feet and a width of 1½ feet.

DRYOPTERIS THELYPTERIS (L.) A. Gray.

Lefroy says this is found "along the north side of Pembroke marsh and not elsewhere," but I found it in a small marsh on the north side of Hamilton, where it grows rather sparingly among dog-bush and *Rhyncospora stellata.*

DRYOPTERIS MOLLIS (Desv.) Kuntze.

Although this fern is given by Hemsley, he tells us that there is no specimen of it in the Kew herbarium from Bermuda. Lefroy states that he planted it out, but does not include it in his list, from which it is to be inferred that the species did not become established. If Hemsley had no specimen of it from Bermuda, it seems possible that he may have accepted Lefroy's effort to naturalize it as an accomplished fact and reported it in accordance therewith. Reade gives it, probably on the same authority, or he might easily have mistaken a specimen of *D. Bermudiana* or even of *D. patens* for *D. mollis.* At all events, it does not seem probable that the species grows in Bermuda now.

DRYOPTERIS VILLOSA (Sw.) Kuntze.

This fern is said by Lefroy to be pretty abundant and to grow in dry places. I found it plentiful in a long "cave" south of the Church cave and also in Trott's cave; also growing on the face of the cliff at Lovers' Nook, Paynter's Vale. The plants were large and apparently very fine, but it was difficult to select fronds that were not ragged or imperfect, although the fern was just in its prime. In fact, this was true of several of the larger ferns, but it may have been caused by the uncommonly dry weather of the month of March.

DRYOPTERIS BERMUDIANA (Baker) Gilbert.

As this is one of the endemic species of Bermuda, and as Mr. Baker's short description of it is in Latin, I will give one in English, drawn from my own specimens.

Caudex thick, shortly creeping, producing a mass of dark brown roots chaffy at the crown with lanceolate long-pointed brown scales 1/4 in. long: stipes about 6 in. long with same scales at base, finely pilose; rachis stramineous like stipes and densely pilose: frond 10–16 in. long, 3–6 in. wide, pinnate, pinnae 1 1/2–3 in. long,

½–1 in. wide with very short petioles, lower pinnae variable, usually slightly reduced but sometimes largest, cut half way to the midrib, very blunt, point entire, dark green on upper side and somewhat canescent, paler on under side: segments uneven in length, blunt, close, entire, basal segments on one or both sides enlarged, texture subcoriaceous: veins beneath pilose, regularly pinnate, 5–7-jugate, lowest veinlets uniting and sending a vein to the sinus as in *Eu-Nephrodium*, simple in smaller specimens and in upper half of frond, but in larger and more mature specimens forked from the middle on inner half of pinnae often uniting at the edge and forming a pentagonal areole, thus bringing the species into the Pleocnemia section: sori small, situated on middle of vein when latter is simple, and at or just above the fork on the anterior veinlet when branched; involucre small, reniform, fugacious.

Mr. Baker places this in *Eu-Nephrodium*, but the probability is that his specimens were not fully developed, although the frond figured in Voyage of H. M. S. Challenger seems to be nearly full sized. The venation of the figure, however, is quite indistinct and does not convey a correct impression of the fern. There seems to be no doubt that it belongs in *Pleocnemia*, and in that light it becomes a highly interesting form, since there is but one species of that section reported as belonging to the western hemisphere, viz., *P. dissidens* from Porto Rico, which Mettenius originally described, but which neither Hooker nor Baker had ever seen.

It should be mentioned that Governor Lefroy supposed this fern to be *Nephrodium tetragonum* Hook. and so catalogued it.

NEPHROLEPIS EXALTATA Schott.

Given by all authorities and common among rocks in the Walsingham district.

POLYPODIUM PLUMULA H.B.K.

Polypodium elasticum Rich.

Both Lefroy and Hemsley give this species under the latter name, and I found it at Paynter's Vale, the locality named for it by Hemsley. Lefroy says it is "found chiefly in the Walsingham tract and not very common." It grew very sparingly this year and the weather had been so dry that the fronds were curled so that it was difficult to make good specimens of them, thus justifying the name *elasticum*, although the older name must take preference. It is a common West Indian species.

POLYPODIUM PECTINATUM L.

Hemsley is the only authority for this species. He gives Walsingham as a habitat, but no special locality. I did not find it, but as it is one of the common ferns of the West Indies I have no doubt it grows in Bermuda. Its superficial appearance is so much like that of *P. Plumula* that it would not be strange if Governor Lefroy mistook it for that species.

ACROSTICHUM AUREUM L.

All the authorities give this as abundant in brackish marshes, but everybody formerly took it for granted that all the plants of this genus growing in Bermuda were of one species. In the marshes on the south shore they do not attain the great size of the plants in the Devonshire marsh, and I feel certain that the former belong to *A. aureum*, as they grow in salt or very brackish water, which is the favorite habitat of *aureum*. I did not collect it there, or make any close examination of the species at the time, supposing, like everybody else, that the plants in both localities belonged to the same species.

ACROSTICHUM LOMARIOIDES Jenman.

This is the species recently separated by Jenman from the familiar *A. aureum*. It is characterized, he states, by "its much larger size, numerous crowded fronds, the barren and fertile being uniformly separate—all the pinnae of the one being barren and all of the other fertile—much more sessile leaflets (turned transversely with the rachis, the plane to the sky like the blades of a step-ladder), intestiniform translucent pale-colored corpuscles covering the sporangia, which give a pale pruinose color to the soriferous under surfaces." I might add that the meshes of venation are much finer and point more directly to the edge, and that the costal areoles, instead of lying lengthwise along the midrib, are generally longer the other way and point outward. The venation is raised on the under side and is more distinct than it is in *A. aureum*, looking like honey-comb, as if it were made of whitish-yellow wax, while in *A. aureum* it is of the same color as the rest of the frond, or darker.

The specimens are very stiff and difficult to press on account of the peculiar position of the pinnae mentioned by Jenman, which makes it necessary to twist them around in order to have them lie in a plane with the rachis.

Jenman gives Bermuda as one of the habitats of this species. The Devonshire marsh, where it grows, lies in the central valley of the large center island known as "the Mainland," and is out of the reach of tide water. The plants strike every one who sees them as being magnificent in size, reaching far above the head of any man, sometimes to the height of eight or nine feet. Mr. Jenman says: "This is the plant figured in Eat. Ferns N. Am. for *A. aureum*, though the true *aureum* is also found in Florida. It (*A. lomarioides*) ranges from Florida and the Bahamas down through the West Indies and Guianas to the Brazils." This, therefore, adds another species to the ferns of our own country. Eaton figures only the fertile frond, but shows a section of a pinna with the sporangia removed, thus disclosing the venation. This is represented as running rather more oblique to the rachis than it does in *A. lomarioides*, but in other respects the figure is very good. It is taken from an Indian River specimen, where, Eaton tells us, the fronds grow very tall and have all the pinnae of the fertile frond fertile and closely appressed to the rachis; which is a correct, condensed description of *A. lomarioides*.

OSMUNDA REGALIS L.

Abundant in Pembroke and Devonshire marshes.

OSMUNDA CINNAMOMEA L.

Abundant in same localities and very luxuriant in growth.

In addition to the above named species, Governor Lefroy put at the end of his list *Blechnum occidentale* L. which, he said, "was planted out in suitable places in 1877." Neither Hemsley nor Reade seems to have had any native specimen of it, nor is there any evidence of its existence there now. It must therefore be regarded as another case of failure to become naturalized.

If we eliminate from this list the species *Dryopteris mollis*, which was evidently catalogued through some mistake, there will remain 25 species and varieties of ferns that may properly be regarded as native or naturalized in Bermuda. An analysis of these species and of the countries where they are known to be indigenous shows that 15 belong to the West Indies, 3 to the continent of North America, 2 to Europe and 1 to the Azores; while 4 are endemic, being the product of Bermuda alone. Thus it is evident that the presence of a great majority of the species can be accounted for by transmission on the waves or winds from comparatively nearby sources. Even the Azorean form of *Asplenium Trichomanes* may well be regarded as a development of that species resulting from insular conditions in both cases. *Adiantum Capillus-Veneris* and *Dryopteris aculeata* are really denizens of the world and liable to be found almost anywhere. There remain the four distinctive species and variety belonging to Bermuda alone; and I leave it for the speculative botanist to determine whether these are the results of evolution, or whether they are the remains of a flora that existed in an earlier geological period when a much greater land surface existed where the Bermudas now lie, and of which they formed the central and most elevated portion.

There is a curious relation between the fern flora of Bermuda and that of Juan Fernandez. The latter is 18 miles long and 6 miles broad, with mountains 3,000 ft. high. Thus while it is not so long as Bermuda, it is so much wider that the superficial area must be somewhat greater, while the high elevation of the land affords a much greater variety of climatic conditions. Their distance from the equator is approximately the same, Bermuda being 32° 15′ N. and Juan Fernandez 33° 37′ S. But while Bermuda is 600 miles from the coast of North America, Juan Fernandez is only 400 miles from the coast of South America. Alfred Russell Wallace informs us that there are 24 species of ferns in Juan Fernandez and that 4 of these are "quite peculiar," by which he means that they are endemic. This lacks only one of the same number of species as are found in Bermuda, and what is still more curious, there is exactly the same number of endemic species. Mr. Wallace declares that the latter fact indicates "the remote period when Juan Fernandez first received its vegetation." If the same reasoning be applied to Bermuda, we shall be led to infer that a portion of the main island at least is of very ancient origin, and that the peculiar species are survivals rather than developments.

Studies in the Botany of the Southeastern United States.—XV.

By John K. Small.

I. NOTEWORTHY SPECIES.

Smilax Morongii.

Smilax megacarpa Morong, Bull. Torr. Club, **21**: 434. 1894.

The specific name under which this characteristic plant was first described was preoccupied* at the time of its publication. Henceforth the species may be designated by the name of the original describer.

Baptisia megacarpa Chapm.; T. & G. Fl. N. A. **1**: 376. 1838.

During the summer of 1895, I found this local species abundantly scattered through swamps of the Flint River below Albany, Georgia. The plants there continued to flower after they had produced mature fruit. The trees forming the woods of the part of the river swamp in which this *Baptisia* grew were almost exclusively magnificent specimens of *Acer Floridanum.*

Euphorbia apocynifolia Small, Bull. Torr. Club, **25**: 467. S. 10, 1898.

Euphorbia corollata, θ apocynifolia Millspaugh, Bot. Gaz. **26**: 268. O. 15, 1898.

Since the publication of this species excellent specimens have reached the herbarium of the New York Botanical Garden, through the National Museum. They were collected at Meridian, Mississippi, on October 10, 1896, by Mr. Charles Schuchert. They are almost exactly like the type and possess all the characters that separate the species so obviously and abundantly from its relatives.

Ceanothus serpyllifolius Nutt. Gen. **1**: 154. 1818.

In the latest interpretation† of this species the author cites a single collection, the original. The species was first collected by

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*A. DC. in DC. Monog. Phaner. **1**: 186.

† Syn. Fl. N. A. **1**: Part 1. Fascicle 2, 410. 1897.

Dr. Baldwin, near St. Mary's, in southeastern Georgia, in the early part of this century. As far as I can learn the species was not met with in the field since the time of the original collection, until Mr. Lewton found handsome specimens of it about Lake Brantley, Orange County, Florida, on July 10, 1894. It is interesting to get the species from a point several hundred miles south of the original station.

SIDA RUBROMARGINATA Nash, Bull. Torr. Club, **23**: 102. 1896.

This excellent species was collected many years ago by Rugel. I find a specimen of it in the Columbia University Herbarium, the label bearing the following record: Ad vis, prope Tallahassee, Florida, legit Rugel, Mai, 1843.

CROTONOPSIS SPINOSA Nash, Bull. Torr. Club, **22**: 157. 1895.

Mr. Lewton found this lately described species abundant in Orange County, Florida, during the summer of 1894. This collection makes the fourth known locality for the species.

CITRULLUS CITRULLUS (L.).

Cucurbita Citrullus L. Sp. Pl. 1010. 1753.

Citrullus vulgaris Schrad. Linnaea, **12**: 412. 1838.

This foreign and widely cultivated species has now become sufficiently well established in waste grounds, along railroads and in similar places to be recognized as a part of our introduced flora. I have collected it at many points in Georgia and North Carolina.

II. HITHERTO UNDESCRIBED SPECIES.

MELANTHIUM DISPERSUM.

Perennial, glabrate below the inflorescence. Stems erect, 6–12 dm. tall, simple below the panicle, thence zigzag and scurfy pubescent, rather slender: leaves without distinction between blade and petiole, narrowly linear, elongated, 3–8 dm. long, sheathing the stem for several centimeters: panicle ample, open; branches zigzag, widely ascending or spreading: bracts 3–10 cm. long, obtuse: pedicels spreading, 8–12 mm. long, rigid: perianth scurfy without, 12–15 mm. broad; segments thickish; blades oblong, obtuse, with 2 glands at the bases, entire, several times longer than the claws: capsules (barely mature) ovoid, 7–9 mm. long.

In woods, western Florida, summer.

Near to *Melanthium Virginicum* but with a different aspect, the leaves are longer and narrower and the panicle, instead of being narrow and with an elongated central axis, is broad, with few corymbosely arranged widely ascending branches and no prolonged main axis. On comparing *Melanthium dispersum* with specimens of *Melanthium Virginicum* from Florida and the Northern States, in addition to the above cited characters, we find the pedicels to be much stouter, and much more widely separated, the flowers less crowded, there being only about one half as many to each panicle and the segments of the perianth with shorter claws.

The specimens on which the species is based were collected by Mr. A. H. Curtiss in Walton county, Florida, in 1885.

✓ SMILAX TENUIS.

Perennial, unarmed. Stems herbaceous, elongated, apparently 1 meter long or longer, commonly simple, slender, glabrous: leaves rather few; blades thin, triangular-ovate, 5–9 cm. long, acuminate, coarsely erose-denticulate, 5-nerved, with an inconspicuous sprinkling of minute hairs beneath, truncate at the base: petioles slender, as long as the blades or shorter: tendrils few, filiform, sometimes developed from the sheaths of the upper leaves: peduncles as long as the subtending leaves or longer, nearly filiform: pedicels (staminate) 15–25, 6–8 mm. long: perianth greenish; segments oblong or linear-oblong, 2.5 mm. long: filaments barely twice as long as the anthers.

In woods, Louisana. Spring.

The nearest described relative of *Smilax tenuis* is *Smilax peduncularis*, but the two species differ conspicuously in habit, the former is quite robust while the latter is very slender. The triangular-ovate leaf blades with their truncate bases and delicate nerves form a strong contrast with the larger, broader and thicker leaf blades of *Smilax peduncularis*, with their cordate bases and very stout prominent and more numerous nerves. The perianth of the newly described species is barely one half as large as that of its relative. The original specimens were collected by Dr. Hale, many years ago in Louisiana.

SMILAX DIVERSIFOLIA.

Perennial, unarmed. Stems herbaceous, 1–3 meters long, climbing, simple or sparingly branched, purplish: leaves numerous; blades ovate or oval-ovate except those accompanying the peduncles, 3–5 cm. long, tipped with an abrupt slightly twisted point, dark green above, pale and minutely pubescent on the nerves and veins beneath, prominently 3-nerved and usually with 2 more indistinct nerves, truncate or subcordate at the base; blades of leaves accompanying the peduncles lanceolate, acuminate: petioles slender, one third to one half as long as the blades: tendrils filiform, developed at the majority of the nodes: peduncles stout, twice or thrice as long as the leaves: pedicels (pistillate) 20–25, 8–10 mm. long, slightly thickened upward: berries subglobose, about 5 mm. in diameter.

In river swamps, Georgia. Spring.

During the spring of 1895, I discovered a curious species of *Smilax* growing in the river swamps of southwestern Georgia, especially in the swamps along the Flint river. It is related to *Smilax herbacea*, but it is more slender and delicate. The leaves are characteristic, the blades are much smaller and more rounded except those accompanying the peduncles; these are wholly different in shape from the other leaf-blades, being lanceolate or narrowly lanceolate. The peduncles are conspicuously elongated and fully twice as long as the accompanying leaves. The original specimens were collected by the writer along the Flint river near Albany, Georgia, May 24–28, 1895.

SMILAX RENIFOLIA.

Perennial, shrubby, glabrous. Rootstocks not seen: stems elongated, climbing high over shrubs and trees, more or less distinctly angled: leaves numerous; blades reniform or deltoid-reniform, 3–7 cm. long, resembling those of *Celtis*, rounded and mucronate at the apex, entire, mostly broader than long, subcordate at the base: petioles 5–10 mm. long; stipular sheath fully half as long as the petioles, usually furnished with tendrils: peduncles of pistillate plants 10–20 mm. long, flattened, much longer than the petioles: pedicels 16–25, 2–3 mm. long: perianth greenish; segments linear or linear-oblong, 2 mm. long, acutish: berries black, subglobose.

Along streams, Texas. Spring.

This Texan *Smilax* is remarkable for its broad *Celtis*-like leaf-blades. These alone furnish a ready means of separating it from *Smilax rotundifolia* with which it has been confused.

The specimens from which the above description is taken were collected by Mr. A. A. Heller along Bear Creek, Kerr county, Texas, on April 30, 1894, no. 1679.

SMILAX CINNAMOMIFOLIA.

Perennial, glabrous. Stems high-climbing, sometimes 10–15 meters long, sparingly armed with slender spines, terete or nearly so: leaves alternate; blades lanceolate or ovate-lanceolate, those on vigorous shoots ample, normally 7–10 cm. long, acute or apiculate, entire, glaucous beneath, cuneate to truncate at the base: petioles 5–10 mm. long; stipular sheath about half as long as the petioles, usually furnished with tendrils: peduncles much longer than the petioles, slender, sometimes 4–5 cm. long at maturity: pedicels 5–10, 6–12 mm. long: perianth greenish; segments linear-oblong or slightly broadened upward, 4 mm. long: anthers mostly longer than the filaments: berries subglobose, about 10 mm. in diameter, bluish-black, lustrous under the glaucous coating.

In woods and rich soil, Alabama and Western Florida to Texas. Spring.

Smilax cinnamomifolia is a southern homologue of *Smilax glauca*, which species it resembles in habit. The leaf-blades are narrower, at maturity often resembling those of *Smilax lanceolata* and suggesting leaves of species of *Cinnamomum*. The upper surface is much more lustrous than that of the leaf-blades of *Smilax glauca* and the berries conspicuously large, commonly twice the size of those of *Smilax glauca*. The following specimens belong here:

Arkansas: Spirit Lake, Texarkana, *Heller*, no. 4109.

Alabama: Auburn, Lee County, November, 1895, *Underwood*.

GYROSTACHYS CONSTRICTA.

Perennial from coarse roots. Stems erect, 3–4 cm. tall, stout, simple: leaves mainly on the lower part of the stem, these linear or narrowly linear-spatulate, 1–2 dm. long, acute, narrowed into margined petioles; those higher up on the stem reduced to sheathing scales: spikes 5–10 cm. long, 2–2.5 cm. thick, closely flowered: bracts lanceolate, as long as the flowers or shorter, acuminate: lip 7–10 mm. long, nearly as long as the sepals and petals, constricted above the middle tip; ovate or deltoid-ovate, much shorter than the base; base ovate, with 2 more or less incurved basal callosities.

In marshes, Louisiana. Fall.

A distinct species related to *Gyrostachys vernalis* but more robust and larger in all its parts. The leaf-blades are much broader and the dilated tip of the lip ovate with a more or less strongly truncate base as compared with the oval or suborbicular tip of the lip in *Gyrostachys vernalis.* The original specimens were collected by Dr. Hale in marshes, Louisiana, no. 444. There is a specimen of this species in Dr. Torrey's herbarium, collected by Prof. L. C. Beck, but no locality is given on the label.

GYROSTACHYS REVERCHONII.

Perennial, light green, 3–6 dm. tall : leaves few ; blades various, those of the basal and lower stem leaves linear or slightly broadened upwards ; those of upper stem-leaves linear, 1–2 dm. long, acute or acuminate, reduced to sheathing bracts high up on the stem : spike long, about 1.5 cm. thick : bracts often as long as the flowers : perianth whitish ; lateral sepals free, acutish ; petals obtuse : lip rhombic ovate, 6 mm. long, obtuse, surpassed by the sepals and perianth, slightly crisped near the apex : callosities stout, slightly curved, pubescent at the base.

On damp prairies, Louisiana and Texas. June.

Gyrostachys Reverchonii is the Texan homologue of *Gyrostachys brevifolia.* The two species are related by the rhombic-ovate lip which is common to both. The Texan species is more robust than *Gyrostachys brevifolia* and its stem is more leafy. The following specimens should be referred here :

Texas : Prairies, Lancaster, Dallas County, June, *Reverchon* [Curtiss, N. A. Plants, no. 2788*].

Louisiana : Damp places, May. *Hale.*

GYROSTACHYS TRILOBA.

Perennial from several cord-like roots. Stems erect, 3–5 dm. tall, slender, sometimes rather weak : leaves mainly near the base of the stem, these oblong or elliptic-oblong, 3–8 cm. long, acute, sheathing at the base, upper stem-leaves reduced to sheathing scales : spikes 4–8 cm. long, about 1.5 cm. thick : bracts lanceolate acuminate, shorter than the flowers : lip oblong, 6 mm. long, about equaling the sepals and petals in length, recurved and 3-lobed at the tip, crisped throughout, cordate with 2 basal callosities.

In sand, Fort Meyer, Florida. Winter.

The species here described bears but little resemblance to any of its relatives, differing considerably in aspect by the oblong or elliptic-oblong leaf-blades. However, the crucial character that separates it from all of its relatives is the three-lobed lip. The original specimens were collected by Mr. J. H. Simpson, at Fort Meyer, Florida, December 11, 1891, no. 368.

OXALIS HIRSUTICAULIS.

Perennial from horizontal rootstock, bright green. Stems erect, 1–2 dm. tall, simple or nearly so, stout, densely hirsute, scaly at base: leaves rather numerous; petioles usually 4–10 cm. long, villous-hirsute: leaflets 3, strigillose or glabrate in age, 1–1.5 cm. long, sharply notched, thickish; peduncles erect or nearly so, surpassing the subtending leaves, pubescent like the petioles, topped by umbel-like cymes: pedicels usually 2, 1.5–2 cm. long, subtended by narrow bracts: sepals 5–6 mm. long, various; outer oblong, inner linear-oblong, all ciliate, thin, obtuse: petals golden yellow, 1.5–2 cm. long, glabrous throughout: filaments pubescent: styles villous-hirsute: capsules columnar, about 1 cm. long: seeds 1.5 mm. long, with low, transverse ridges.

In open woods, near Nashville, Tennessee.

For several years I have hesitated to publish this excellent species although to thrust it into any of the species to which it is related does violence to the clear lines separating those species from one another. On the one hand it is related to *Oxalis macrantha*, but differs in its upright habit and the copious spreading pubescence, on the other hand it can be compared with *Oxalis recurva*, but it is very much more robust, its pubescence is of a hirsute type rather than villous, then, too, the inflorescence does not conspicuously surpass the leaves and the styles are not recurved in the characteristic manner in which those of *Oxalis recurva* are.

The original specimens were collected by Dr. A. Gattinger in the vicinity of Nashville, Tennessee. Besides specimens in the Herbarium of Columbia University I have had the use of ample specimens from the Herbarium of the University of Tennessee, through Professor S. M. Bain.

OXALIS BUSHII.

Perennial by horizontal rootstocks, bright green. Stems erect, 1–2 dm. tall, nearly simple, pubescent with spreading hairs: leaves few; petioles slender, pubescent near their bases like the stem; leaflets 3, 1–1.5 cm. long, sharply notched, strigose or glabrate: peduncles slender, nearly erect, solitary or usually so, overtopping the leaves, glabrous except near the base, topped by umbel-like cymes in which 1 or 2 flowers mature at a time; these accompanied by several drooping buds: pedicels appressed pubescent: sepals oblong, 3.5–4 mm. long, obtuse, ciliolate: petals light yellow, 8–10 mm. long, emarginate or rounded at the apex: filaments much dilated at the base: styles slightly pubescent: capsules not seen.

In dry soil, Missouri and Arkansas. Spring and summer.

As in the case of *Oxalis hirsuticaulis*, I have hesitated several years before publishing the above described species in the hope that some other solution of the problem of its disposal might present itself. The species is so distinct that it is impossible to include it under any species thus far described. *Oxalis recurva* is its nearest relative and it somewhat resembles that species in its young stage, but it is much more fleshy and the stems are not tufted on the rootstocks. The short obtuse sepals and the pale yellow corollas form quite a contrast with the fully thrice larger golden-yellow corollas of *Oxalis recurva*.

The original specimens were collected by Mr. B. F. Bush in Jackson County, Missouri, June 28, 1893, no. 30.

OXALIS PRICEAE.

Perennial from slender creeping rootstocks. Upper part of the stem, petioles, peduncles and pedicels pubescent with very delicate spreading hairs. Stems erect, soon becoming decumbent, 1–3 dm. long, wire-like, more or less branched: leaflets 3, digitate, obcordate, deep green above, pale or glaucescent beneath, 6–9 mm. long, ciliate: peduncles slightly longer than the petioles or shorter, pedicels about as long as the corolla, deflexed at maturity: sepals linear or nearly so, 7 mm. long, pubescent at the base and the tip: petals deep yellow chrome, about 1.5 cm. long, finely pubescent without, ciliate, rounded or truncate at the apex: styles (in plants examined) 6–7 mm. long, densely villous: capsule columnar, 10–15 mm. long.

In open woods, middle Kentucky. Summer and fall.

A remarkable species related to *Oxalis recurva* and *Oxalis macrantha*. It resembles the latter species in habit and in the color of the foliage, and like it, the inflorescence is not elevated above the leaves, but the pubescence is spreading. The pubescence is similar to that of *Oxalis recurva* but much more delicate, the flowers too resemble those of that species in aspect, but the styles are erect. The most peculiar character is the pubescent and strongly ciliate petals. I do not know that this character exists in any of our many yellow-flowered species. Miss Sadie F. Price, for whom this *Oxalis* is named, has furnished me with copious material from near Bowling Green where she has observed this and other interesting species in the field for several years.

PHYSOSTEGIA DIGITALIS.

Perennial, glabrous below the inflorescence. Stems erect, 7–12 dm. tall, stout, sharply 4-angled: leaves opposite; blades leathery oblong to elliptic-oblong, 10–22 cm. long, acute or acutish at the apex, undulate or repand-serrate above the middle, sessile and partly clasping at the base: racemes simple or branched, finely pubescent: bracts lanceolate or ovate-lanceolate, 4–6 mm. long: pedicels very short: calices 8–10 mm. long; tubes turbinate or cylindric-turbinate; segments lanceolate, acuminate, about one half as long as the tube: corollas barely puberulent along the back, 2–2.5 cm. long; tube rather abruptly dilated into the throat; lower lip spreading, lobes oblong, middle one emarginate, about twice as large as the lateral ones; upper lip slightly undulate.

In low grounds, Louisiana. Summer and fall.

Few specimens of this species have reached our herbaria. The plants are more robust than those of *Physostegia Virginiana* and the large broad entire or merely repand-toothed leaf-blades form a conspicuous contrast with those of the common species. A comparison of the flowers of the two species under consideration shows the calyx of the newly described one to be larger and the corolla smaller than the corresponding members in *Physostegia Virginiana.* The original specimens were collected many years ago in Louisiana. The one was gathered on prairies by Mr. Carpenter while the other is from Alexandria, collected by Dr. Hale.

EUPHORBIA OLIVACEA.

Perennial, olive green, glabrous. Stems solitary or several together, 2–7 dm. tall, simple or branched at the base; branches erect or ascending, forking above or topped by a 4-rayed umbel; leaves alternate below the umbel; blades leathery, oblong, obovate-oblong or cuneate, 1–3 cm. long, obtuse or notched at the apex, with a stout midrib, sessile or short-petioled: involucres scattered along the slender branchlets, campanulate, with a truncate base about 1 mm. high, angled at maturity: glands transversely oblong, about 0.5 mm. broad; appendages ascending, white, 1 mm. long, orbicular-cuneate, minutely erose at the top.

In sandy soil, southern Mississippi. Summer.

Related to *Euphorbia apocynifolia* but the foliage is perfectly glabrous and the stems very rigid. The plants are conspicuous on account of the numerous leaves on the stem and the many small thick broad bracts scattered on the elongated branches of the inflorescence. A good character is furnished by the involucres; these are truncate at the base. I am not aware that this character exists in any other member of the group. The original specimens were collected by Prof. S. M. Tracy at Biloxi, Mississippi on July 15, 1894, nos. 2883 and 2885.

EUPHORBIA ERIOGONOIDES.

Perennial, deep green, glabrous. Stems several or many together, 1–3 dm. long, diffusely branched into a rounded head 1–3 dm. in diameter; branches very slender, zigzag, widely dichotomous, ultimate divisions nearly filiform: leaves opposite, above first fork, reflexed or deflexed; blades linear or linear spatulate, .5–1.5 cm. long, obtuse or acutish, entire, barely petioled: peduncles filiform, 3–8 mm. long at maturity: involucres campanulate with a rounded base, less than 1 mm. high, erect or ascending: glands reniform, about 0.5 mm. broad; appendages ascending, reniform-cuneate, white or pink, about 1 mm. broad, 0.5 mm. long, longer than the gland, some truncate, some cleft: capsules not seen.

In loose sand, eastern Georgia. Spring and summer.

A very characteristic species on account of its close resemblance to *Eriogonum cernuum* and some of its relatives. The stems are diffusely branched from the base and the branches thence widely dichotomous. The leaves at the nodes are reflexed or deflexed and often curved. The very numerous involucres are less than 1 mm. high, while the white or pink appendages are only about 0.5 mm. long and about 1 mm. broad. The small size of the members of the inflorescence and the characteristic habit separate it from all other species of *Tithymalopsis.* The original specimens were collected by the writer in the sands about Darien Junction, in eastern Georgia, June 25–27, 1895.

EUPHORBIA ZINNIIFLORA.

Perennial, dark green. Stems usually solitary, erect, 3–5 dm. tall, with a few ascending branches below the 3-rayed umbel, pubescent with short scattered hairs: leaves alternate except those subtending the umbel; blades narrowly linear-lanceolate, or nearly linear, 2–5 cm. long, mostly reflexed or deflexed, acute or rather obtuse, sparingly pubescent above or glabrate beneath, somewhat revolute, nearly sessile or with somewhat hairy petioles less than 1 mm. long: peduncles slender, erect, 1–3.5 cm. long, angled especially above: involucres campanulate, 1.5–2 mm. high, angled: glands oblong-reniform, fully 1 mm. broad; appendages spreading, white or pink, suborbicular or 4-sided, 3–3.5 mm. long, barely as broad, rounded or emarginate at the apex.

In sandy soil, Yellow River valley, Georgia. Spring.

While collecting in the Yellow River valley in middle Georgia during the spring of 1895, I encountered a curious looking *Euphorbia*, growing in the sands of the river swamp. The habit of the species is peculiar, the few branches of the main stem and the rays of the main umbel are terminated by several-rayed-umbels with narrow spreading leaf-life bracts. The rays of these ultimate umbels are filiform, or nearly so, and characteristically elongated. The leaves are conspicuous on account of their reflexed or deflexed position. As compared with *Euphorbia eriogonoides*, the involucres of this species are very large, sometimes measuring one centimeter across the appendages and closely resemble in aspect the heads of species of *Zinnia*. The body of the involucre differs from that of most other, if not all members of the subgenus *Tithymalopsis* in being broader than high.

EUPHORBIA PERGAMENA.

Biennial or perennial, glaucescent. Stems branched at the base; branches slender, wire-like, 0.5–1.5 dm. long, glabrous or nearly so, forking; leaves opposite; blades parchment-like, oblong or ovate, very oblique, 3–6 mm. long, obtuse, serrulate, minutely pubescent on both sides, conspicuously inequilateral, cordate or subcordate at the base, short-petioled: involucres campanulate, 1–5 mm. high, minutely pubescent, with a split on one side through which the pedicel protrudes: glands transversely oblong, purple or red-purple, variable in size, about 0.5 mm. broad; appendages white or pink, as long as the glands or longer, one much longer than the others, more or less uneven along the edges: capsules about 1 mm. high, minutely pubescent: seeds less than 1 mm. long, faces transversely wrinkled.

In sand, peninsular Florida.

The specimens on which the above described species is founded were collected in peninsular Florida by both Dr. Garber and Mr. Simpson, and were both distributed under the name of a species to which they are rather remotely related and bear but slight resemblance. The nearest relative seems to be *Euphorbia prostrata*. The newly described species can easily be distinguished by the much stouter root and more numerous and wiry branches. The leaves are conspicuously parchment-like and not fleshy; in short, the plants belonging here have a dry and rigid texture as compared with the fleshy and flaccid herbage of their relatives.

The following specimens are referred here; Florida: Miami, November, 1878, *Garber;* Lemon City, March 2, 1892, *Simpson*, no. 523.

HYPERICUM APOCYNIFOLIUM.

A branching shrub 4–7 dm. tall with a red somewhat shreddy bark. Branchlets narrowly 4-winged: leaves bright green; blades oblong or slightly broadest near the middle, 2–4 cm. long, rounded or emarginate at the apex, rarely revolute, pale beneath, minutely punctate, more or less cuneate at the base, nearly sessile: flowers 3–5 in terminal cymes: sepals spatulate, elliptic or oval, 3–5 mm. long, fully one half as long as the petals, obtuse or acutish, persistent: petals yellow, oblong, 8–9 mm. long: capsules oblong-conic, 12–13 mm. long, acute: seeds cylindrical or slightly constricted about the middle, barely 2 mm. long, minutely but conspicuously reticulated.

In swamps, Arkansas and Texas. Summer.

Probably most if not all of the Texano-Arkansas *Hypericum nudiflorum* may belong to the above descriped species. *Hypericum apocynifolium* is related to *Hypericum nudiflorum* but it is rigidly distinct. The best diagnostic characters are to be found in the flowers, these are somewhat larger than those of the eastern relative. The sepals are fully one half as long as the petals, while the capsules are 12–13 mm. long, being of a narrower pattern and fully twice as large as those of the species with which it has been confused. My attention has recently been recalled to this species by specimens collected near Texarkana during the closing season.

The species was also collected in Arkansas many years ago by Dr. Leavenworth.

GAURA FILIFORMIS.

Perennial, finely canescent. Stems erect or ascending, 1–2.5 m. tall, widely and often diffusely branched above; branches very slender, sometimes nearly filiform: leaves numerous but not conspicuously so; blades linear to narrowly linear lanceolate, 2–10 cm. long, or shorter on the branches, acute or acuminate, rather sharply but remotely serrate or entire towards the inflorescence: spikes elongated and interrupted: calyx puberulent; tube 7–8 mm. long; segments longer than the tube: petals pink-purple, oblong with a narrowed base, about 7 mm. long, obtuse: filaments 5–6 mm. long: anthers 4 mm. high: style surpassing the filaments: fruit narrowly elliptic, 6 mm. long, sessile, canescent, faces slightly ridged.

In sandy banks, Arkansas and Louisiana. Summer and fall.

Related to *Gaura angustifolia*, but very much larger, commonly reaching a height of two and one half meters and copiously and diffusely branched throughout. The narrower acuminate almost entire leaf-blades, the closer pubescence, the pink-purple corollas and the smaller fruit all serve to separate the newly described species from *Gaura angustifolia*.

The specimens on which the species is based were collected by Mr. A. A. Heller, near Texarkana, Miller County, Arkansas, August, 1898, no. 4138. The species is also represented in the Herbarium of Columbia University by a specimen collected many years ago in Louisiana, the label accompanying the specimen contains the following record: "Prairies. Fel[iciana] and Op[elousas]. Sept. 5th. Wm. C[arpenter].

VERBENA HALEI.

Annual, slender. Stems erect, 2–9 dm. tall, 4-angled, glabrous or strigillose above, branching near the top or rarely at the base: leaves strigillose, 3–10 cm. long; blades various, those of the basal and lower stem leaves oblong to ovate, irregularly toothed and incised, long-petioled, those of middle part of stem commonly broader, 1–2-pinnatifid, shorter petioled: upper ones sparingly toothed or entire: spikes slender; bracts shorter than the calyx, appressed: calyx becoming 3–3.5 mm. long, strigillose; teeth mucronate: corolla blue; tube about 3 mm. long; limb 6–7 mm. broad, segments notched: nutlets linear-oblong, about 2.5 mm. long.

In sandy soil, Indian Territory to Louisiana and Texas. Spring and summer.

Verbena Halei has the general habits of *Verbena officinalis* but differs from that species in both the leaves and inflorescence. The lower leaf-blades are usually less deeply lobed, often merely coarsely toothed, while the upper leaves or leaf-segments are conspicuously elongated and nearly entire or remotely toothed. The corollas are twice the size of those of *Verbena officinalis* and the narrow fruit often fully twice the length of that of the eastern relative. The following specimens belong here:

Louisiana: *Dr. Hale*, no. 245.

Texas: San Diego, 1885–86, *Miss Croft*, no. 119; Corpus Christi, 1894, *Mr. Heller*, no. 1419.

Indian Territory: Between Fort Cobb and Fort Arbuckle, 1868, *Dr. Palmer*, no. 242.

GERARDIA POLYPHYLLA.

Annual, smooth and glabrous or nearly so. Stems erect, 1–4 dm. tall, bushy; branches wire-like, ascending: leaves opposite, numerous; blades linear filiform or setaceous, 1–2.5 cm. long, acute, straight or somewhat curved, slightly revolute: pedicels filiform, spreading, 1–2 cm. long, surpassed by the leaves: calices 2–3 mm.; tubes turbinate; teeth triangular-subulate, one fourth as long as tube: corollas pink or pink-purple, less than 1 cm. long.

In sandy soil, Little Stone Mountain, Georgia. Summer and fall.

The species of *Gerardia* just described is related to *Gerardia setacea* Walt., but it is more delicate and all its members are smaller. All the plants that I have seen are conspicuously much branched and the small corollas and the large calyx-teeth which are fully one fourth as long as the turbinate tube easily separate the species from any forms of *Gerardia setacea* with which I am acquainted.

The original specimens were collected by the writer on Little Stone Mountain, DeKalb County, Georgia, in September, 1895. Specimens which without much doubt will have to be referred here have now been brought in by Mr. Heller from the vicinity of Texarkana, Arkansas, no. 4219. These are almost identical with the Georgia plants.

GERARDIA VIRIDIS.

Annual, slightly scabrous, drying green. Stems erect, 2–6 dm. tall, branching, sharply angled: leaves opposite or slightly scattered; blades narrowly linear, 1–2 cm. long, acute, revolute, scabrous along the edges, sessile or nearly so: pedicels ascending, 8–15 mm. long, as long as the leaves or shorter, slender: calices 4–5 mm. high; tubes turbinate to turbinate-campanulate; teeth acute, about one third as long as the tubes: corollas yellowish-pink, less than 1 cm. long; segments ciliate, truncate or barely emarginate.

In sandy soil, Arkansas to Louisiana. Summer and fall.

At least two species in addition to the type are passing under the name *Gerardia Skinneriana.* The one I have just separated in the above description can be easily recognized by the coarser habit, the larger and broader leaves and the long calyx-teeth; these form a strong contrast with the minute teeth of the calyx of *Gerardia Skinneriana.* Mr. Heller has collected excellent specimens of the species about Texarkana, Arkansas, during the past season, no. 4240. Dr. Hale found it many years a little further south at Alexandria, Louisiana.

SOLIDAGO HELLERI.

Perennial, robust. Foliage nearly glabrous: stems erect, 6–16 dm. tall, usually green mottled with purple, branched above into wide spreading panicles: leaves numerous; blades narrowly elliptic or oblong-elliptic, 3–10 cm. long, acute, serrate with appressed teeth at least above the middle, smooth and glabrous above, sparingly pubescent beneath, ciliate, sessile or nearly so above: racemes one-sided, slightly recurved; bracts linear or linear-spatulate: involucres cylindric, about 6 mm. high, spirally twisted; bracts glabrous, erect, firm, leathery, linear or linear-lanceolate, conspicuously decurrent on the peduncle: rays 2–4, yellow, inconspicuous, partly included; blades oblong, 1–1.5 mm. long.

In sandy woods, Arkansas.

Solidago Helleri is related to *Solidago rugosa* and *Solidaga ulmifolia*, possessing the general habit of the former and in the foliage characters nearest to the latter. It differs from both relatives in its peculiar heads; these members are supported on slender peduncles, which are often copiously furnished with delicate bracts. These bracts grade into those of the involucre proper, and, like those of the involucre, are strongly spirally arranged, giving a conspicuous twist to the heads.

The plants on which the species is founded were collected by Mr. A. A. Heller, near Texarkana, Bowie County, Texas, September, 1898, no. 4188.

DOELLINGERIA SERICOCARPOIDES.

Perennial, deep green. Stem erect, 8–12 dm. tall, corymbosely branched above, finely ridged, purple or purple-mottled, glabrous to the ultimate divisions or near them; leaves numerous; blades firm, elliptic to lanceolate-elliptic, acute or slightly acuminate at the apex, somewhat scabrous above, glabrous and paler beneath or minutely pubescent on the nerves beneath, ciliate, narrowed into short petioles or nearly sessile: peduncles minutely pubescent: involucres cylindric-campanulate, about 4 mm. high, 2–2.5 mm. thick; bracts very sparingly pubescent, outer linear-lanceolate, inner linear, ciliate at the tip: rays white, 2–4, oblong, 5–6 mm. long: mature heads about 8 mm. high: achenes almost glabrous.

In low grounds, Arkansas and Texas. Fall.

The *Doellingeria* inhabiting the lower Mississippi valley is undoubtedly specifically distinct from all the recognized species. It was separated from related forms in Torrey and Gray's Flora of North America and recognized as a species by Schultz Bipontinus in the Meisner Herbarium. However, as far as I can learn, it has never been given a name. From the other species of the genus it may be distinguished by the more rigid habit and the firmer texture of the leaves, but the most characteristic distinction lies in the inflorescence; this is quite suggestive of the species of *Sericocarpus* in the ultimate clusters, but the branches of the inflorescence are conspicuously elongated. The small heads which are only about half the size of those of its relatives furnish a crucial character. The original specimens were collected by Mr. A. A. Heller, near Texarkana, Miller County, Arkansas, in August and September, 1898, no. 4137.

ASTER CONTINUUS.

Perennial, deep green. Stems erect, pubescent with short upcurved hairs, simple below, much branched above, slightly flexuous: leaves spreading; blades 2–4 cm. long, somewhat fiddle-shaped, acute, shallowly serrate or nearly entire, ciliolate, scabro-pubescent on both sides, sessile, clasping at the base: inflorescence ample; branches spreading, slender, closely pubescent, furnished with many approximate bract-like scales: heads showy: involucres turbinate, short before anthesis, elongated to 1 or 1.5 cm. at maturity: bracts numerous, linear or nearly so, acute, erect or slightly spreading, with narrow dark green tips, conspicuously decurrent on the peduncles: rays 12–15, violet, nearly linear, about 1 cm. long: achenes pubescent.

In dry soil, Arkansas. Fall.

Aster continuus is one of the more conspicuous species of the genus. Its relationship is with *Aster patens.* Differences in habit and foliage are much subornate to the very peculiar involucres. Up to about the time the rays expand these members are turbinate, but after the rays expand and the head matures the involucres become conspicuously obconic and greatly elongate. The bracts of the involucre have often a conspicuously spiral arrangement and gradually pass into those of the elongated peduncles. The original specimens were gathered by Mr. A. A. Heller, near Texarkana, Arkansas, in September, 1898, no. 4283.

III. THE PARONYCHIACEOUS GENUS FORCIPELLA.

Unfortunately the name FORCIPELLA which I lately associated with a genus of PARONYCHIACEAE was used in the family ACANTHACEAE* since the publication of the Kew Index and before my adoption of it. This being the case, I cannot do better than associate the name of the late Professor Lewis R. Gibbes, of Charleston, South Carolina, the discoverer of such conspicuous species as *Aster mirabilis* and *Tsuga Caroliniana*, and founder of an important herbarium,† with this interesting genus:

GIBBESIA.

GIBBESIA RUGELII (Chapm.).

Siphonychia Rugelii Chapm. Fl. S. States 47. 1860.

Paronychia Rugelii Shuttl.; Chapm. Fl. S. States 47. As synonym. 1860.

Forcipella Rugelii Small, Bull. Torr. Club, **25**: 150. 1898.

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* See Engler and Prantl, Nat. Pfl. Fam. **4**: Abh. 3, b. 343.

† This herbarium is now incorporated in the herbarium of the New York Botanical Garden.

Exposure and fungous Diseases.*

BY BYRON D. HALSTED.

Exposure has something to do with the attack of parasitic fungi and this may be of at least two kinds—to the elements—sunshine, air, moisture, etc., and to the germs of the disease. Both of these sets of conditions work together for the production of infection.

Some striking illustrations of the value of exposure to the germs in the success of inoculation have come under the writer's notice within the past year. Attention is directed to the infestation of a young growth of asparagus to the rust fungus, *Puccinia asparagi* DC. On September sixth, while inspecting asparagus fields in Gloucester county, New Jersey, the writer came to a field with quite an unusual green appearance, nearly all the fields being brown and lifeless so far as the brush was concerned, having been killed by the remarkable ravages of the rust fungus. The field in question had been cut over and the very rusty brush removed about five weeks before, with the hope that the new growth might escape the ravages of the *Puccinia.* At the date of the inspection the brush was about hip high and showing the rust only upon one side of each plant. So strikingly one-sided was the output of the rust sori that one could scarcely fail to observe it. Every main stem was almost completely covered with the rust upon one side, while the opposite bore almost no spots. It was also noticed that this rusted side varied somewhat at different ends of the long field, and at all points was at right angles to lines drawn from an old and very badly rusted bed of asparagus that stood with its end towards the broad side of the field in question and about forty rods away.

This observation teaches something concerning the rapidity of the development of the rust fungus. As the brush must needs have been developed to some extent before the uredospores could have alighted upon them, and as also it is fair to judge that many of the sori upon the plants were fully ten days old, therefore not more than two weeks might have elapsed from the time when the spores came to the asparagus plants to that when sori were giving off their spores. The season was unusual, July being a very rainy month, and the long wet period continued into August, followed by hot moist weather particularly favorable for the development of fungi.

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*Prepared for the Botanical Club of the A. A. A. S., Boston, Mass.

That the source of infection was the old asparagus bed is beyond question. About midway between the two beds stands a house and a few trees around it, and it was observed that there was less rust upon that portion of the new bed that was in line with this house and the old bed. In short, there was a barrier between the old bed and the new that interfered with the free passage of the spores. When the surface of the rusted stems of the old bed were dry and the winds blew from it towards the new bed, the spores were doubtless carried in great abundance, and these spores alighting upon the tender stems of the young shoots, encouraged by hot dewy nights, quickly germinated and rusted the plants. There is no reason to doubt that some of the rust spores were carried by the winds to long distances and infected plants miles from where they were produced.

A single other instance may be mentioned in passing that appears to have escaped previous observation. The hollyhock rust (*Puccinia malvaccarum* Mont.) is very abundant in some gardens in New Jersey. The normal place for the production of the sori of this rust is upon the under surface of the leaf blades, but in very badly infested plants the veins and petioles of the leaves and even the stem of the hollyhock bear the rust spots. The point of observation is this, that when the petioles are rusted the disease is confined almost entirely to the upper side.

It is possible that here there may be a working together of the exposure to the germs and the favorable meteorological conditions for the development of the spores.

As in the asparagus rust the infection is rapid, but here it is by means of sporidia and not by uredospores as in the *Puccinia asparagi.* These sporidia are borne abundantly by the leaves above and might naturally drop upon the upper surface of the petioles, the hairiness of which would tend to hold them. It is possible that the warmth of the spring sun upon the moist upper surface furnishes the conditions that favor the growth of the sporids.

An examination of the stems, some of which were badly rusted, showed that the side towards the center of the group of stalks were the most affected.

This leads naturally to a study that was made of bacteriosis in beans briefly mentioned with an engraving in Mycological Notes in the June issue of the BULLETIN.

"The rows ran nearly north and south and upon the east side of the plants there was but a small amount of the bacteriosis (*Bacillus phaseoli* Sm.) to be seen, while upon the west side nearly every pod of the green flageolet variety was more or less blotched, many of them literally covered with the bacterial ulcers, which were in many instances of an amber color, due to the multitude of the germs of the bacillus that had collected in a layer upon the surface."

Fully nine tenths of all the blotches were upon the western sides of the pods and about two fifths of all the pods of the variety in question were badly affected.

Strong winds upon the 17th and 20th of September bent the plants to the southeast, from which they did not fully recover. As a result, at the time the above observations were made, October 5th, the plants all leaned several degrees from the perpendicular and some of the pods were likewise tilted. In short, the foliage of the plants hung chiefly upon the eastern side of the row and had done so for between two and three weeks, and therefore one side of each pod was more exposed than the other, and that exposure was, speaking generally, in the direction of the four o'clock sun.

It had been previously observed that the leaves of the plants under consideration were badly blighted for weeks before the pods became noticeably injured, and it is not unlikely that the germs were carried from the diseased leaves to the pods by the dripping dews, in which case the side that was slightly inclined upward on account of the slanting posture of the plants would receive a more generous supply of the germs than the more protected underside.

It is possible that the bending of the plants so exposed the pods that they became more or less injured by the sun and thus provided more favorable conditions for the development of the bacteria. The warmth of the sunny side may have been sufficient to make the difference observed.

All the circumstances may have combined to bring about the results that were so strikingly evident. The bending of the plants and the swinging of the foliage to the eastward, the inclining of the pods and the exposing of the upper surface, that would naturally receive the drips from the diseased leaves, the autumn sun during the afternoon, either adding the required warmth for the germs or partially scalding the side most exposed and thus render the tissues more susceptible to attack are all still open questions.

One cannot but wonder what the result might have been had the plants been pressed back into place after the storm or a portion of the plot been shaded or even if the rows had run east and west instead of north and south.

If spores pass through the air, as is the common belief, there is nothing particularly obscure in the observations in the asparagus field, and the hollyhock rust upon the upper side of the petiole is only an instance of the drips from an infested leaf naturally reaching the nearest side, while the bacteriosis of the bean deals with the unequal conditions for growth upon different sides of the bean pod due to more favorable ones obtaining upon the one than the other. Doubtless many other instances like the ones cited may be found when one is upon the watch for them.

RUTGERS COLLEGE.

New and interesting Plants from Western North America.—IV.

By A. A. Heller.

FENDLERELLA gen. nov.

[Fendlera § Fendlerella Greene, Bull. Torr. Bot. Club, **8**: 26. 1881.]

Low, cymosely much branched shrubs, with small, opposite, or subverticillate leaves, narrowed at the base, and sparingly appressed pubescent: the slender branches terminated by compound cymes, which bear small, white flowers, these five-merous: calyx cylindrical turbinate, pubescent, its lobes oblong: petals oblong, unguiculate: capsule oblong, affixed to the calyx-tube for half its length: cells one-seeded.

Fendlerella Utahensis (Wats.)

Whipplea Utahensis Wats. Amer. Naturalist **7**: 300. 1873.

Fendlera Utahensis Greene, Bull. Torr. Bot. Club, **8**: 26. 1881.

Originally collected by Mrs. E. P. Thompson, at Kanab, in Southern Utah, "on dry rocky cliffs; July, August." That this plant is not a *Whipplea* is evident, neither does it agree much better with the genus *Fendlera*, with its large usually solitary flowers, tetramerous, and its ovoid capsule, which is attached to the calyx-tube only at the base. At first sight, dried specimens suggest *Ceanothus Fendleri*. Good specimens were collected by Dr. D. T. MacDougal in the Grand Cañon of the Colorado, Arizona, June 26, 1898, no. 158.

Inadvertently the wrong authority was cited in my treatment of a species of *Opulaster* on page 581 of this volume. The citation should read as follows:

Opulaster pauciflorus (T. & G.)

Spiraea opulifolia, γ pauciflora T. & G. Fl. N. A. **1**: 414. 1840.

Spiraea pauciflora Nutt. MSS.; T. & G. Fl. N. A. **1**: 414. 1840.

Neillia malvacea Greene, Pittonia, **2**: 30. 1889.

This species was also collected by Douglas at the "Kettle Falls," now known as Spokane Falls, but his specimens, as well as Nuttall's original, were referred to *O. monogynus*, a species inhabiting the middle and southern Rocky mountain region.

LINUM AUSTRALE sp. nov.

Annual (?), usually somewhat corymbosely branched from the base, 2–3 dm. high, the stem ascending, glaucous, puberulent, angled, especially in the upper half, leafy throughout; leaves narrowly linear, .5–1.5 cm. long, 1 mm. wide, one-nerved, more or less glandular ciliate, especially the upper ones: sepals linear-lanceolate, about 5 mm. long, one-nerved or keeled, light colored at the base, greenish above, glandular ciliate, awn-pointed: petals pale yellow throughout, little longer than the calyx: capsule ovoid, between 3 and 4 mm. long, somewhat obtuse.

Our no. 3724, first collected on an open slope in dry ground, at the head of the reservoir, four miles east of Santa Fé, New Mexico, June 17, 1897, altitude 7,500 feet. Later it was obtained eleven miles southeast of Santa Fé, along the road leading to Cañoncito. At this second station it grew on dry slopes which were sparsely clothed with pine trees. The type is in the herbarium of the New York Botanical Garden.

Only two species of *Linum* were observed in the vicinity of Santa Fé, this species and *Linum puberulum* (Engelm.) Heller, but the latter was seen only on the lower ground to the north and west of the town.

To *Linum australe* belong Prof. E. O. Wooton's no. 592, collected in the White mountains, Lincoln County, New Mexico, July 30, 1897, altitude 6,800 feet, as well as Dr. D. T. MacDougal's no. 379, collected August 4, 1898, on the slopes of Mt. San Francisco, near Flagstaff, Arizona.

GALIUM WATSONI (A. Gray)

Galium multiflorum, var. *Watsoni* A. Gray, Syn. Fl. N. A. **1**^{2}: 40. 1884.

Described as "mostly glabrous and smooth; leaves thinner, oblong-lanceolate (commonly about half an inch long and 2 lines wide), with lateral nerves either distinct or obsolete.—*G. multiflorum* Watson, l. c. (Bot. King Exped. 135) in great part." From description, the type of this would be no. 484, collected on the Wahsatch mountains, Utah, August, 1869, altitude 8000 feet. But on the same sheet in the Columbia University Herbarium, and under the same number, 484, are two other specimens, which are not of this species. One was collected on the Wahsatch mountains, Utah, July, 1869, and the other on the East Humboldt mountains, Nevada. These have shorter, rounder, pubescent leaves.

Specimens of *G. Watsoni* were collected on the slopes of the Grand Cañon of the Colorado, Arizona, by Dr. D. T. MacDougal, June 26, 1898, no. 157.

ERIGERON TETRAPLEURUS (A. Gray)

Erigeron stenophyllum, var. *tetrapleurum* A. Gray, Proc. Am. Acad. **8**: 650. 1873.

Erigeron Utahensis A. Gray, Proc. Am. Acad. **16**: 89. 1880.

Specimens which appear to belong with this species, were collected by Dr. D. T. MacDougal, in the Grand Cañon of the Colorado, Arizona, June 28, 1898, no. 188. Why Dr. Gray changed the name of this plant when he raised it to specific rank, is not apparent, as the varietal name seems to be perfectly valid. While looking up the original description and synonomy of this plant, I discovered that two other species bear names which are untenable:

ERIGERON GRAYI nom. nov.

Erigeron stenophyllus A. Gray, Pac. R. R. Surv. (Whipple Expedition) **4**: 98. 1857. Not *Erigeron stenophyllus* H. & A. 1836, nor *Erigeron stenophyllus* Nutt. 1847.

The type of this was collected "on hillsides and steep banks of the Pecos; October," by Dr. J. M. Bigelow. The particular place meant is the ford of the Pecos in New Mexico, on the Santa Fé trail, not far from where the Santa Fé railroad now crosses the stream.

ERIGERON NUTTALLII nom. nov.

Erigeron stenophyllus Nutt. Journ. Acad. Phila. (II) **1**: 176. 1847. Not *Erigeron stenophyllus* H. & A. 1836.

Erigeron foliosum var. *stenophyllum* A. Gray, Bot. Cal. **1**: 330. 1876.

MACDOUGALIA gen. nov.

Perennial herbs, the stems from a multicipital caudex, usually simple, covered with floccose tomentum when young : leaves narrow, mostly basal, neither impressed punctate nor resinous atomiferous : heads solitary, large, radiate ; involucre hemispherical, its bracts in two rows, all lanceolate, awn-pointed, little shorter than the broad, obtusely conical receptacle, those of the inner series slightly longer and narrower than those of the outer : paleae of the pappus almost as long as the disk flowers, subulate-lanceolate.

This species, formerly included in the genus called *Actinella*, which has recently been well segregated by Professor Greene, appears to me to be worthy of generic rank. In habit it is more like the genus *Tetraneuris*, but has a different involucre, and while its involucre is somewhat similar to that of the genus *Picradenia*, there is a wide difference in habit. The following species is the only one recognized :

MACDOUGALIA BIGELOVII (A. Gray)

Actinella Bigelovii A. Gray, Pl. Wright. **2** : 96. 1853.

The type was collected by Dr. J. M. Bigelow, in 1851, "on mountains near the copper mines, and near the Mimbres, New Mexico, April, June." Dr. D. T. MacDougal's no. 2, collected near Flagstaff, Arizona, May 31, 1898, is referred here for the present, although it may prove distinct.

411 WEST WALNUT STREET, LANCASTER, PA.

Two recently named Genera of Basidiomycetes.

By Lucien M. Underwood.

The publication of the parts of *Die natürlichen Pflanzenfamilien* relating to fungi have presented some phases of ancient practice still in use at Berlin that we supposed belonged only to the earlier ages of plant nomenclature. One of these is so prominent a violation of all canons of nomenclature that we must protest against it. It consists in widening the scope of a genus already established and then giving an uncalled-for new name to the group thus established.

Kalchbrenner * gave the name *Boletinus* to a group of *Boleti* of which *B. cavipes* Opat. was the type. Later Peck † extended the genus so as to include other forms in which the pores were somewhat radially arranged and whose pore-layer separated with difficulty from the hymenophore. In the last issue of the Basidiomycetes, ‡ Herr Hennings has still further modified the genus so as to include *Boletus cavipes* Opat. which he places in "Sect. III. Boletinus Kalchbr." together with *B. rufus* Schaeff., *B. luteus* L. and other European and American species, and proceeds to baptize the whole combination with the name *Boletopsis* P. Henn. We are amazed that this sort of thing is permitted at a center where strict attention is supposed to be given to correct nomenclature and where specific rules have emanated that have had world-wide notice and criticism. *Boletopsis* P. Henn., is therefore a worse than useless synonym, and *Boletinus* Kalchbr. must stand in its place.

Another error of an earlier issue of the same work, namely the establishment of the genus *Kneiffiella* P. Henn. needs correction and we take the task in hand the more readily because the first oversight of a previous genus of the same name in recent literature here made by Herr Hennings, was made by us nearly a year prior to the date of publication of exactly the same name in *Die*

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* Icones sel. Hym. Hung., 52. 1877.

† Bull. N. Y. State Mus. **2** : 74. 1889.

‡ Engler-Prantl. Die natürlichen Pflanzenfamilien, 1^1 * * : 194. 1898. This awkward and needlessly complex form of citation for a volume is characteristically clumsy and indicates a lack of attention to detail which editors should never allow.

natürlichen Pflanzenfamilien. Herr Hennings has committed a double error in that he has not only overlooked the original publication of *Kneiffiella* by Karsten, but also its establishment by us in 1897 as a substitute for *Kneiffia* Fr., thus making it appear as a new generic name "*Kneiffiella* P. Henn." an exact equivalent of the generic name we had substituted. Herr Hennings has, however, been careful to galvanize all the species under his new genus, a practice of literary revision always greatly to be deplored and especially unfortunate in this case, as the work will have to be done again.

Since *Kneiffiella* as a substitute for *Kneiffia* Fr. is untenable in the presence of *Kneiffiella* Karst,* which was established for an entirely different plant which has not been included under *Kneiffia* Fr. we shall make another attempt to relieve the difficulty by proposing the following new generic name :

PYCNODON.†

[KNEIFFIA Fr. Epicrisis systematis Mycologici, 529. 1838. Not *Kneiffia* Spach, Hist. Veg. Phan. **4**: 373. 1835 (Epilobiaceae).]

[KNEIFFIELLA Underw. Bull. Torr. Bot. Club, **24**: 205. 24 Ap. 1897.]

[KNEIFFIELLA P. Henn. Die nat. Pflanzenf. **1**^{1**}: 139. 1898. Not *Kneiffiella* Karst. Krit. Ofversigt af Finlands Basidsvampar, 371. 1889.]

The type of Fries' genus was *Thelephora setigera* Fr. Elench. Fung. 208. 1828, which is a synonym of *T. aspera* Pers. Mycol. Europ. **1**: 153 (excl. icon.). 1822. The type species will now be known as *Pycnodon asperum* (Pers.)

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* Kritisk Ofversigt af Finlands Basidsvampar, 371. 1889. The genus was monotypic, founded on *Hydnum barba-Jovis* Bull. (*Odontia barba-Jovis* Fr.).

† From *πῦκνός*, crowded, and *ὀδούς* tooth.

New Species of Lichens from Southern California determined by Professor W. Nylander.

By H. E. Hasse.

Lecanora praecrenata Nyl.

Thallus of rugose furfuraceous small distinct rounded squamules or united to larger ones and then rimose, with a rounded lobulate outline of light green clay color: apothecia from one-half to less than one millimeter in diameter; disk flat, black, pruinose, with a permanent crenate white margin: spores 4–6 in asci, globular, 20 in diameter, with finely granular contents. Hym. Gelat. J. + blue, changing to greenish yellow, which color the spores at once assume.

Of the *L. cinerea* group. On disintegrated granite and clay. Barton's Peak, Santa Monica Mountains.

Arthonia pruinosella Nyl.

Thallus effuse, white with a flesh-colored tint when wet, epiphlaeoidal: apothecia small, round, to larger and oblong, elevated, dark brown to black, slightly pruinose, with a thin scaly thalline margin: spores simple and 1–3-septate, oblong, 12–16 μ long, 5–6 μ wide.

On *Cordia* sp.—a Brazilian shrub or tree cultivated at the Agricultural Experiment Station at Santa Monica.

Thelopsis subporinella Nyl.

Thallus indistinct of small pale ochraceous colored globules, between thickly studded concolorous more elevated globular immersed apothecia, forming patches from one-half to one centimeter in diameter, with an irregular outline: epithecium darker, punctiform, depressed: "thecae polysporae, sporis oblongis, 120–140 μ long. 4 μ crass." Simple or 1-septate.

On bark of *Umbellularia Californica*. Malibu Cañon, Santa Monica Mountains. August, 1898.

Lecidea triphragmioides Nyl. sp. nov.

Thallus cartilaginous rugulose, rimose, areolate, ash colored: apothecia numerous, small to medium; disk black, papillate, flat to slightly convex and indistinctly pruinose; margin black, thick, prominent, crenulate and undulate or angular: hypothecium brown: spores broadly fusiform with acuminate ends, 28 μ long, 8 μ thick: paraphyses thick, adglutinated. "Sporae fuscae J. Gel. Hym. fulvo-rufescens."

On bark of *Rhamnus Californica* along the beach near Santa Monica. August, 1898.

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ERRATA.

P. 221, six lines from the bottom. Read 4–6: 1 in place of 8–15: 1.
P. 221, four lines from the bottom. Read 8–15: 1 in place of 4–6: 1.
P. 336, fourth line. Read Americanas in place of Americanus.
P. 336, seventh line. Read petiolulatis in place of petiolatis.
P. 336, eighteenth line. Read paginam in place of paginem.
P. 336, six lines from the bottom. Read sub-petiolulata in place of sub-petiolata.
P. 336, five lines from the bottom. Read pellucidis in place of pellucidus.
P. 336, three lines from the bottom. Read tomentella in place of tomentelli.
P. 337, fifth line. Read videtur in place of vindetur.
P. 337, fifth line. Read *Serjaniam nutantem* Poepp. in place of serjaniam nutantem.
P. 337, eleventh line. Read ingressu in place of ingressa.
P. 337, fifteenth line. Read mucigera in place of macigera.
P. 337, seventeenth line. *Dele* et.
P. 337, eighteenth line. Read parce in place of parve.
P. 337, twenty-fourth line. Read Guanai in place of Guanii.
P. 337, fourteen lines from the bottom. Read Serj. in place of Serg.
P. 337, fourteen lines from the bottom. Read 1875 in place of 1895.
P. 337, ten lines from the bottom. Read pagninam in place of pagninem.
P. 337, eight lines from the bottom. Read flavescente in place of flabescente.
P. 337, six lines from the bottom. Read obovato in place of obovata.

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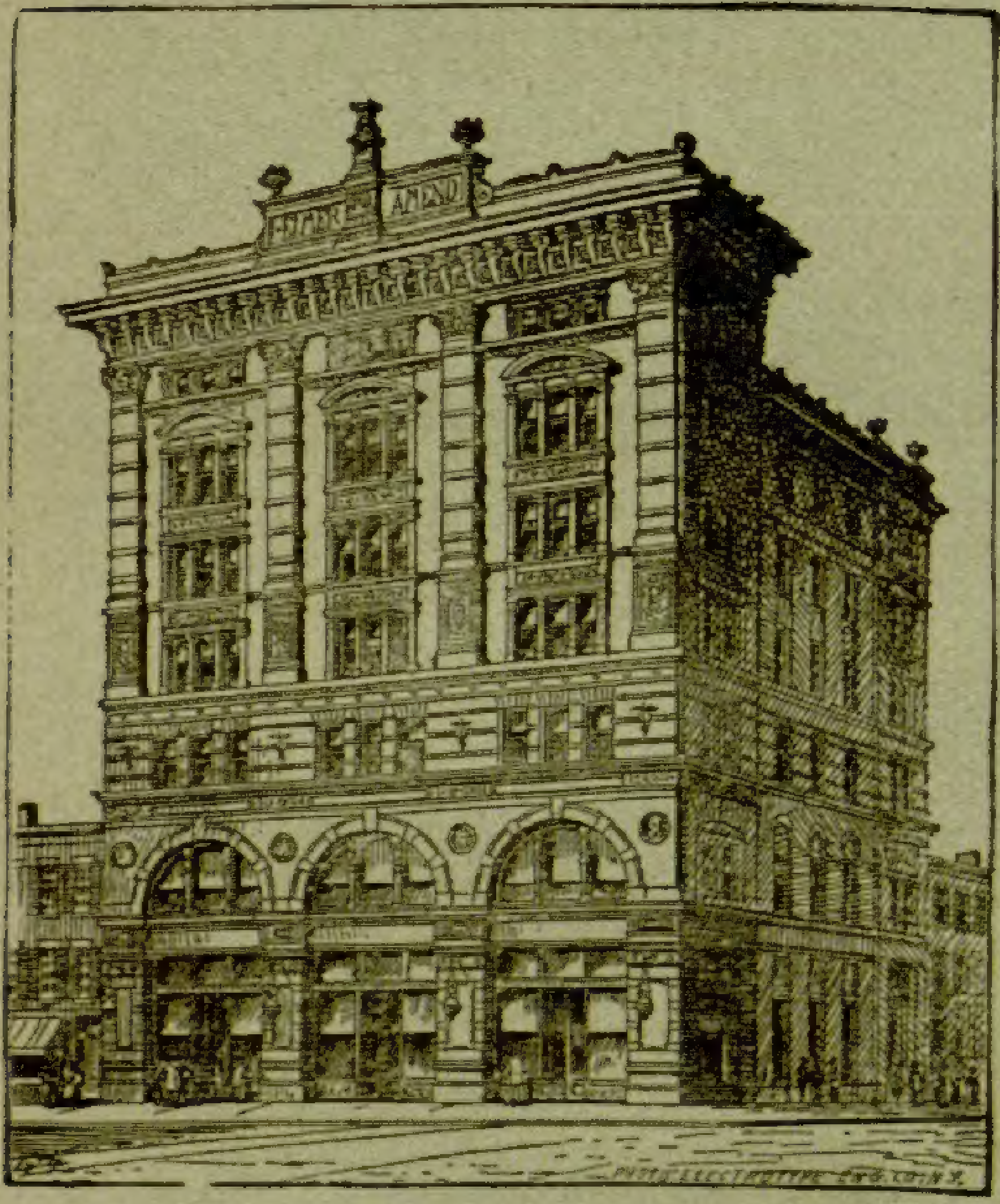

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